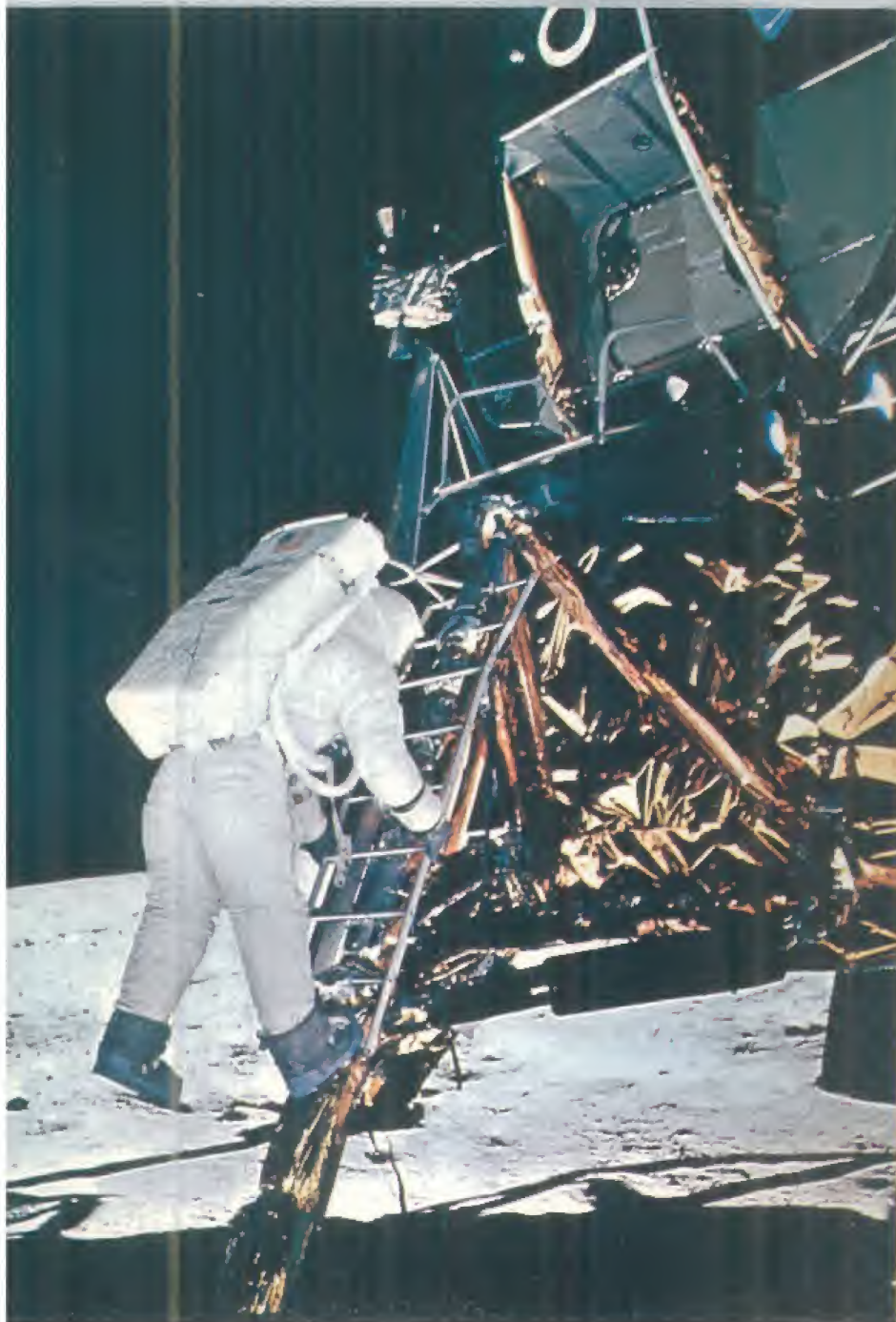


A SUBSIDIARY OF DAMON

## **MODEL ROCKETRY CATALOG**

Estes Industries, Inc. Box 227, Penrose, Colo. 81240



## ORDERING INFORMATION

### GENERAL INFORMATION

This catalog takes effect as of October 20, 1970 and replaces all previous catalogs. Please be sure that you use the correct and full catalog number for each item you order. All prices are subject to change without notice. **WHEN SENDING ORDER BE SURE TO GIVE ZIP CODE IN YOUR ADDRESS.**

### POSTAGE

**Estes Industries ships all retail orders postpaid in the U.S. by regular land mail** or by the customer's choice of carrier. If the customer requests a carrier other than regular land mail he will be charged for any additional shipping costs. On a few items our price is slightly higher than normal list on the item. The difference in prices is due to our policy of paying postage on all items.

### PAYMENT ON ORDERS

Full payment must accompany all orders. Please send all remittances by either check or money order, both for your protection and our convenience. If you do send currency, be sure your envelope has sufficient postage, is properly sealed, and is addressed correctly, so we will receive your order. Coins should be attached to a separate sheet of paper, not to the order blank. Use a single strip of masking tape to hold the coins in place. Avoid the mailing of coins, as they are easily lost in the mail. We cannot assume responsibility for the loss of coins, currency or orders in the mail. Remember to include sufficient funds with your order. For your protection, **we do not ship orders C.O.D.** Proper attention to these details will result in speedier service for you.

### CAUTION

We believe that we have the safest program offered in the field of rocketry today. However, it is still important that the utmost care be exercised in the use of our products. We **DO NOT** assume any responsibility for accidents. No warranty is either made or implied as to reliability or performance. We assume no liability beyond the cost of replacement of a product, if any, which misfunctions or is found defective.

Your order may, for various reasons, have to be shipped in more than one package. For example, postal regulations permit us to ship no more than 27 engines per parcel. If all of your order does not come at the same time, please be patient — give the post office, U.P.S. or freight company a few days to mix things up and sort them out again.

**NOTE:** All foreign orders require additional postage. Please write for more information on postage and mailing restrictions.

order form



USE THIS CONVENIENT  
ORDER FORM FOR FAST  
SERVICE

Your rocket supplies will  
be on their way to you  
the same day we receive  
your order!

# order form

**MAIL  
TODAY**

NOW... you can  
step into the real  
world of space...

with  
ESTES  
Model  
Rockets...





## CONTENTS:

	<u>PAGE</u>
The Estes Story . . . . .	6
Welcome to The Real World of Space . . . . .	7
Building and Flying Model Rockets . . . . .	8
Starter Kits . . . . .	11
Guide to Model Rocket Selection . . . . .	15
Model Rocket Kits:	
For Beginning Rocketeers	
Single-Stage . . . . .	17
Two-Stage . . . . .	23
For Advanced Rocketeers	
Single-Stage . . . . .	25
Boost Gliders . . . . .	31
Multi-Stage . . . . .	33
Scale Flying Models . . . . .	37
Exotic Designs of the Future . . . . .	47
Special Purpose Model Rockets . . . . .	51
Cameras: Camroc and Cineroc . . . . .	52
Technical Section . . . . .	57
Engines . . . . .	89
"D" Engine Design Notes . . . . .	96
Launch Control Systems and Supplies . . . . .	98
Designing Your Own Rockets . . . . .	108
Building Tools and Supplies . . . . .	116
Parts for Custom Design . . . . .	126
Cross Reference Guide . . . . .	140
Index . . . . .	142
Safety Code . . . . .	145

## The ESTES Story...

In the late 1950's there was a very real and urgent need for model rocketry. The first Sputnik had been launched, and everyone wanted to join in the "race for space". Thus, attempts were being made to build rockets from "home-brew" fuels and metal pipes, with disastrous results. In those early days of our space activities, the American Institute of Aeronautics and Astronautics estimated an "amateur" rocketeer had a one-out-of-seven chance of being seriously injured or killed in each year he participated. Concern for a way to direct the scientific space-age interests of these young people towards constructive activities, and away from their own destruction, prompted Vern Estes in 1958 to begin developing a process for making a safe, solid-propellant model rocket engine.

Thus, Vern's first two years were spent designing and building the world's first automated model rocket engine manufacturing machine, affectionately called "Mabel". Then in 1960, he and his wife Gleda began selling model rockets by mail order. It soon became apparent that a safety-engineered model rocket engine for use with paper and balsa wood rockets would allow America's youth to launch rockets in almost perfect safety, and while doing so be a real part of the exciting world of space. From a humble beginning of only two people, the Estes team has

now grown to nearly 400 dedicated employees, each doing his special job to serve the more than 1,000,000 active rocketeers. The Estes plant now encompasses over forty buildings and is located on a 300-acre site.

A key element in the growth of the company has been the personal interest shown by Vern and his staff in the needs and well-being of each customer. No letter goes unanswered and each idea, plan or design suggested by a customer is given careful consideration for use in the Estes Space Program. As Vern often says, "It's our customers who have made this company great."

After Estes Industries moved from Denver, Colorado to Penrose in August of 1961, the small community soon became widely and appropriately known as "The Model Rocket Capital of the World". Then in 1969, the company took another big step in its growth when it merged with the Damon Corporation of Needham Heights, Massachusetts, a larger, public-held firm, listed on the American Stock Exchange. With additional capital for expansion, Estes is now moving to further develop its capability to better serve the interests of all rocketeers and to develop other exciting innovations in the scientific world in which we live.

ESTES INDUSTRIES, INC. PENROSE, COLORADO 81240



A SUBSIDIARY OF DAMON

## Welcome to the real world of space...

If you're an "old pro" at model rocketry, you already know the excitement and enjoyment of this great hobby. But if you have just discovered model rocketry, you're about to launch into a new world of accomplishments.

Within a short time you'll assemble your first rocket. You'll take it to a carefully selected site and check it out for the last time.

Like the scientists at the Cape, you will start the countdown, 5-4-3-2-1-liftoff! Like them, you'll whisper "Go, baby, go!" And like them, experience a tremendous feeling of relief and satisfaction when everything is A-okay and the parachute blossoms out for a safe return.

As you progress in your rocket activities, you will find the Estes Model Rocket Program involves more than just a place to buy rockets. The Catalog's yellow pages, our Technical Reports (TR's) and other publications are designed to help you become a real "pro". You will also regularly receive free copies of the Model Rocket News, thus keeping you informed of our latest developments.

As time goes by, you will graduate to more advanced models — like the INTERCEPTOR I'm holding below; the SATURN V, the big one that took us to the moon! and the incredible CINEROC, the color movie camera which records in spectacular reality all that happens from blast-off to separation and recovery.

We hope you will enter the Design of the Month Contest. Also, if you like, send us your ideas and suggestions for new developments. Each will be studied carefully and many put to use. Thus, you can also play an important part in developing and maintaining the world's safest and most advanced program in model rocketry.

Thousands of young people are sharing these experiences with you. Some of them — maybe you — first challenged by our Estes models, will open new frontiers in space for America and the world.

Enjoy your new hobby. Learn from it. Our hopes and good wishes ride with you all the way.

Sincerely,

Vern Estes





# Building and flying model rockets.



- 1 Rocket is launched electrically from launch pad.
- 2 Powered flight.
- 3 Model coasts upward to peak altitude during time delay.



## BASIC BUILDING

Start by building and flying the Alpha. Study Technical Report TR-1\* concerning rocket stability principles.

## STABILITY STUDIES

Increase your understanding of stability principles by building and flying the Scout.

## DESIGN PLANNING

Study Technical Report TR-9\*\*. It is an excellent guide for creating your own single stage rocket. Build and flight-prove your own design.

## MULTI-STAGING

Learn about multi-staging with a 2-stage Apogee. Technical Report TR-2\*, explains stage coupling separation and upper stage ignition.

Add to your skill in multi-staging by building and flying a 3-stage Farside, using experience gained from the Apogee.

## CUSTOM DESIGN

Build and fly your own multi-stage model, using the techniques you've learned.

\* Tech Reports are included with kits.  
\*\* TR-9 must be ordered separately.  
See page 112



- 4 Engine ejection charge activates to deploy the chute or other recovery system.
- 5 Model rocket drifts safely back to earth.
- 6 Gentle landing... ready for lift off again.



## BOOST-GLIDE

This is departure from the traditional rocket. Build and fly the Falcon which combines rocket and glider characteristics. Technical Report TR-7\* gives you precise instructions on FRONT ENGINE models.

Broaden your boost-glide skills with the Space Plane, a REAR ENGINE model. Study Technical Report TR-1\*, you'll gain further knowledge in the art of balancing for maximum performance.

Now, test the boost-glide principles you've learned from the Space Plane and Falcon.

Design and build your own boost-glider.

## CLUSTERING

This is the technique of simultaneously igniting more than one engine. Master it by building the Scrambler, studying TR-6\* and launching a payload with your model. Continue by building and flying the Astron Ranger or one of the clustered Estes scale models. Then build a cluster model of your own.

## PHOTOGRAPHY

You can take pictures of your rocket flights. Color movies or still photography.





## STARTER KITS:

### PORTA-PAD STARTER KIT

- High-flying, easy-to-assemble Alpha III Kit, 3 engines, instructions.
- Porta-Pad — sturdy tripod rod launcher and Launch Control System.
- Fact-filled Estes Design Manual.

Start with this complete outfit. The Astron Alpha III is easy to build and fly. Plastic nose cone and fins. Demonstrating most rocketry principles, it can attain altitudes of 1000 feet or more. Parachute recovery brings your "bird" back for flight after flight. Both the Porta-Pad launcher and the complete Launch control ignition system will serve you well throughout your rocketry career. To get you off to the right start, the comprehensive Estes Design Manual is included.

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Shipping wt 3 lbs

**STARTER KIT INCLUDES:** Alpha III Kit, 3 engines — Two A8-3's and One B6-4 Launch Control System, FS-5, Porta-Pad Launcher; Design Manual; instructions. Batteries not included. Recommended batteries: Ray-o-Vac No. 918, Eveready No. 731, Burgess TW-1, or any 6 or 12 volt car battery.

Cat. No. 701-KS-7 **\$7.00**

### BEGINNER'S SPECIAL

For those who have a launcher available or wish to build their own (instructions included) all the above items except the field box, Porta-Pad and launch control system are included. Shipping wt 12 oz

Cat. No. 701-KS-2 **\$2.25**





Electro Launch  
STARTER  
KIT

DELUXE  
STARTER  
KIT

## STARTER KITS:

### ELECTRO LAUNCH STARTER KIT

- Alpha III Rocket
- Electro-Launch
- Estes Design Manual
- Two Safety Engineered Engines

This starter outfit features the famous self-contained Electro-Launch, "the biggest little launcher in the world", for quick set-up to launch from any location. Also included is the easy-to-assemble, high-flying Alpha III, 2 engines, 4 Photo-Flash batteries, and Design Manual. Shipping wt. 3 lbs. 5 oz.

Field Operations Box included at no extra cost!

Cat. No. 701-DSK-75

**\$7.50**

### DELUXE STARTER KIT

- Alpha Rocket  
(Balsa Nose Cone and Fins)
- Launch Control System
- Porta-Pad Launcher
- Estes Design Manual
- Three Safety Engineered Engines

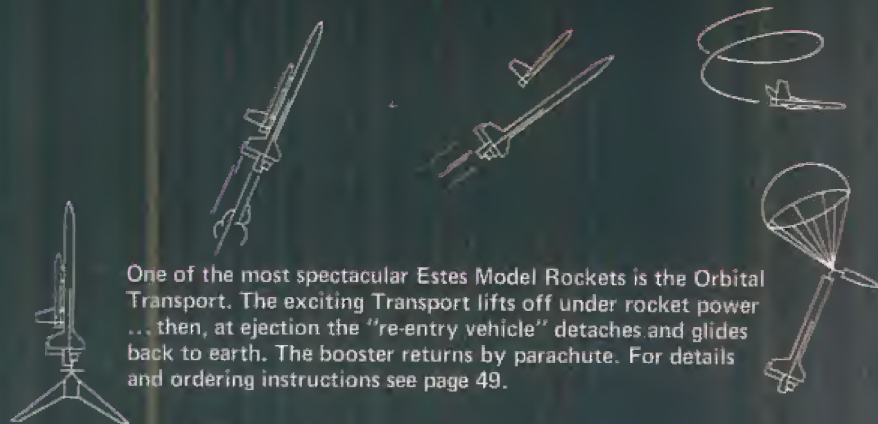
It's all here! This is the most complete outfit offered to build, finish and fly a model rocket. At one low price you get everything needed to get ready for launch: rocket, instructions, engines, launcher, electrical ignition system, tools and paints. All you need is the battery power for ignition. Use with car battery or others listed on page 11.

Packaged in a reusable field box with handle and compartments for engines, supplies, tools, etc., this outfit is perfect — especially if you've done no model building before.

Kit includes all construction and finishing materials — a knife, glue, sandpaper, paints, brush, brush cleaner — supplies which can be used in building several more rockets. Shipping wt. 3 lbs. 8 oz.

Cat. No. 701-KS-8

**\$8.50**



One of the most spectacular Estes Model Rockets is the Orbital Transport. The exciting Transport lifts off under rocket power ... then, at ejection the "re-entry vehicle" detaches and glides back to earth. The booster returns by parachute. For details and ordering instructions see page 49.

## GUIDE TO MODEL ROCKET SELECTION

Use this chart to help guide you to the right model rocket for your particular purpose.

ROCKETEER SKILL LEVEL	ROCKET DESCRIPTION	DEGREE OF CHALLENGE	SELECT THIS KIT	SEE PAGE
FOR THE BEGINNING ROCKETEER	SINGLE STAGE	1	ALPHA ALPHA III MARK SKY HOOK	17
			X-RAY STREAK BIG BERTHA SCOUT	19
	TWO STAGE	3	SPRITE DRIFTER CONSTELLATION	21
		3	MIDGET SHRIKE	23
2	BETA AVENGER			
FOR THE ADVANCED ROCKETEER	SINGLE STAGE	2	COBRA CHEROKEE-D RANGER	25
		3	SCRAMBLER STARLIGHT	27
			GYROC STAR BLAZER SPRINT	29
	BOOST GLIDERS	4	NIGHT HAWK SPACE PLANE FALCON	31
	MULTI-STAGE	3	APOGEE FAR SIDE	33
			DELTA OMEGA	35
	SCALE FLYING MODELS	2	SANDHAWK WAC CORPORAL	37
		3	AEROBEE 300 V-2	
		4	THOR AGENA B APOLLO SPACE CAPSULE HONEST JOHN ARCAS	39
			SATURN V (Semi-Scale) GEMINI TITAN	41
			SATURN V SATURN 1B	43
		5	LITTLE JOE MERCURY REDSTONE	45
			EXOTIC DESIGNS	2
	3	INTERCEPTOR		
	4	ORBITAL TRANSPORT TRIDENT MARS SNOOPER MARS LANDER		49
	SPECIAL PURPOSE MODEL ROCKET KITS		1	SPACEMAN PHANTOM BIRDIE

DEGREE OF CHALLENGE IN ASSEMBLING THE KIT  
 1 = EASY  
 2 = FAIRLY EASY  
 3 = AVERAGE  
 4 = DIFFICULT  
 5 = VERY DIFFICULT

Weights given on the following pages are without engines.



**BEGINNING ROCKETEERS:** Single Stage  
**Degree of Challenge:** One

First choices for beginning rocketeers. Easy-to-build. Easy-to-fly. These birds deliver dependable high-flying performance from lift-off to parachute recovery (except the Mark, which is streamer recovery). All kits come complete, ready-to-build with instructions. Engines not included.

**Astron  
ALPHA**

Estes' most popular rocket. It will still be a favorite as your fleet grows.

**Specifications**

Length 12.25"  
 (31.1cm)  
 Body Dia 0.976"  
 (24.8mm)  
 Weight 0.8 oz  
 (23 gr)  
 Shipping wt 5 oz

**Recommended  
Engines**

1/2A6-2 B4-4  
 A8-3 B6-4  
 A5-4 C6-5  
 Use A8-3 for first flights.

Cat. No. 671-K-25  
**\$1.50**

**NEW  
ALPHA III**

Just like the Alpha except it's easier to assemble and fly. Plastic nose cone and fins.

**Specifications**

Length 12.25"  
 (31.1cm)  
 Body Dia 0.976"  
 (24.8mm)  
 Weight 1.2 oz  
 (33.9 gr)  
 Shipping wt 10 oz

**Recommended  
Engines**

1/2A6-2 B4-4  
 A8-3 B6-4  
 A5-4 C6-5  
 Use A8-3 for first flights.

Cat. No. 711-K-56  
**\$1.50**

**Astron  
MARK**

Ideal for sport or demonstration flying. Top-notch performance every time.

**Specifications**

Length 9.1"  
 (23.1cm)  
 Body Dia 0.765"  
 (19.4mm)  
 Weight 0.7 oz  
 (20 gr)  
 Shipping wt 5 oz

**Recommended  
Engines**

1/2A6-2 A5-4  
 A8-3 B6-4  
 C6-5  
 Use 1/2A6-2 for first flights.

Cat. No. 651-K-2  
**\$1.25**

**Astron  
SKY HOOK**

An exciting but easy-to-build rocket. Terrific performance flight after flight.

**Specifications**

Length 12"  
 (30.5cm)  
 Body Dia 0.765"  
 (19.4mm)  
 Weight 0.7 oz  
 (20 gr)  
 Shipping wt 5 oz

**Recommended  
Engines**

1/2A6-2 A5-4  
 A8-3 B4-4  
 B6-6 C6-7  
 Use 1/2A6-2 for first flights.

Cat. No. 651-K-8  
**\$1.35**

**Plastic Replacement Parts  
 FOR ALPHA III**

Nose Cone	711-PNC-50K	.50
Fins	711-PFS-50A	.50

**BEGINNING ROCKETEERS:** Single Stage  
**Degree of Challenge:** One

These kits are your next step on the way to becoming a real expert. They are still easy-to-build and fly, single stage rockets but with some special purpose features. All kits come complete, ready-to-build with instructions. Engines not included.

#### Astron X-RAY

Features a large see-through payload section. Perfect for research work of all kinds. Parachute recovery.

#### Specifications

Length 16.75"  
(42.5cm)  
 Body Dia 0.736"  
(18.7mm)  
 Payload Sec. Dia 0.976"  
(24.8mm)  
 Weight 0.7 oz  
(20 gr)  
 Shipping wt 5 oz

#### Recommended Engines

1/2 A6-2 B14-5  
 A8-3  
 B6-4 C6-5  
 Use A8-3 for first flights.

Cat. No. 651-K-18  
**\$1.75**

#### Astron STREAK

Light weight (1/8 oz. without engine) and wind-cheating design...terrific for contests and records. Featherweight recovery.

#### Specifications

Length 5.6"  
(14.2cm)  
 Body Dia 0.720"  
(18.3mm)  
 Weight 0.1 oz  
(3 gr)  
 Shipping wt 4 oz

#### Recommended Engines

1/4A3-2 A8-5  
 1/2A6-4 B6-6  
 A5-4 C6-7  
 Use 1/4A3-2 for first flights.

Cat. No. 701-K-4  
**.70**

#### Astron BIG BERTHA

Ideal for demonstration flights. Slow realistic take-off that fascinates all spectators. Parachute recovery.

#### Specifications

Length 24"  
(61cm)  
 Body Dia 1.637"  
(41.6mm)  
 Weight 2.2 oz  
(64 gr)  
 Shipping wt 11 oz

#### Recommended Engines

A5-2 A8-3  
 B4-2 B6-4  
 C6-5  
 Use B6-4 for first flights.

Cat. No. 701-K-23  
**\$3.00**

#### Astron SCOUT

This kit teaches balance principles. A must for the rocketeer learning to design his own models. Tumble recovery. Includes Tech Report on Stability. Pat. No. 3,114,317

#### Specifications

Length 7"  
(17.8cm)  
 Body Dia 0.765"  
(19.4mm)  
 Weight 0.3 oz  
(9 gr)  
 Shipping wt 2 oz

#### Recommended Engines

1/4A3-2 1/2A6-2  
 A5-4 A8-3  
 B6-4 C6-5  
 Use 1/4A3-2 for first flights.

Cat. No. 651-K-1  
**.70**





**BEGINNING ROCKETEERS:** Single Stage  
**Degree of Challenge:** Three

These kits will round out your fleet with some unusual rockets. Outstanding flight performance and beautiful lines... perfect for all types of flying... impressive to show. Parachute recovery (except for the Sprite). All kits come complete, ready-to-build with instructions. Engines not included.

#### **Astron SPRITE**

This unusual little rocket teaches importance of proper rocket balance. At the end of a straight-up launch the Sprite tumbles back down close to the launcher. Great for small field. Includes Tech Report on Stability. Patent No. 3,114,317

#### **Specifications**

Length	5.3" (13.5cm)
Body Dia	0.765" (19.4mm)
Weight	0.3 oz (9 gr)
Shipping wt	5 oz

#### **Recommended Engines**

1/4A3-2S    1/2A6-2S  
 A5-4S  
 Use 1/2A6-2S for first flights.

Cat. No. 701-K-15  
**\$1.00**

#### **Astron CONSTELLATION**

The perfect single-stage high performance rocket for payload work or just fun flying. Long slender lines, "landing shocks" on each fin tip give a futuristic look. See-through payload section.

#### **Specifications**

Length	16.2" (41.4cm)
Body Dia	0.976" (24.8mm)
Weight	1.0 oz (28 gr)
Shipping wt	5 oz

#### **Recommended Engines**

1/2A6-2    A8-3  
 A5-4    B6-4  
 C6-5  
 Use A8-3 for first flights.

Cat. No. 681-K-35  
**\$2.00**

#### **Astron DRIFTER**

Low weight and large chute capacity make this tough bird great for competition, test or sport flying. Inter-changeable chutes: 24" for competition and 12" for test and sport.

#### **Specifications**

Length	14.3" (36.3cm)
Body Dia	0.976" (24.8mm)
Weight	1 oz (28 gr)
Shipping wt	5 oz

#### **Recommended Engines**

1/2A6-2    A8-3  
 B6-4    C6-5  
 Use 1/2A6-2 for first flights.

Cat. No. 651-K-14  
**\$1.85**





## BEGINNING ROCKETEERS: Two Stage

**Degree of Challenge:** Two (Beta, Avenger)  
Three (Shrike, Midget)

Multi-staging represents the next level of rocketry skills. Demonstrates how real space ships operate. The first stage is always ignited electrically. Second stage ignition occurs automatically upon the burnout of the first stage. All kits come complete, ready-to-build with instructions. Engines not included.

### Astron MIDGET

No midget in performance, this unique two-stage rocket gets the most out of the smaller series III engines. Graceful flight, fast takeoff. Parachute for upper stage. Booster tumbles down.  
Pat. No. 3,292,302

#### Specifications

Length 9.25"  
(23.5cm)  
Body Dia 0.976"  
(24.8mm)  
Weight 0.6 oz.  
(16gr)  
Shipping wt 6 oz.

#### Recommended Engines

UPPER STAGE  
1/4A3-4S  
1/2A6-4S  
A5-4S  
Use 1/2A6-4S for first flights.

BOOSTER  
1/2A6-0S A5-0S  
Use 1/2A6-0S for first flights.

Cat. No. 682-K-40  
**\$1.25**

### Astron SHRIKE

New easy staging method...just insert engines, plug the stages together and you're ready to go! Pre-cut fins. Transparent payload section with foam end pads.

#### Specifications

Length 29.5"  
(74.9cm)  
Body Dia 0.976"  
(24.8mm)  
Weight 2.25 oz.  
(64gr)  
Shipping wt 11 oz.

#### Recommended Engines

UPPER STAGE  
1/2A6-4 A5-4  
A8-5 B6-4  
B6-6 B14-7  
C6-7  
Use B6-6 for first flights.

BOOSTER  
A8-0 B6-0  
B14-0 C6-0  
Use B6-0 for first flights.

Cat. No. 701-K-46  
**\$4.75**

### Astron BETA

Sleek and trim, this bird really goes! Easy-to-build, the Beta can be flown single stage or with a booster for high flights. Low weight, streamlined design with parachute recovery.  
Pat. No. 3,292,302

#### Specifications

Length 13.75"  
(34.9cm)  
Body Dia 0.738"  
(18.7mm)  
Weight 0.75 oz.  
(21 gr)  
Shipping wt. 6 oz.

#### Recommended Engines

UPPER STAGE  
1/2A6-2S  
1/2A6-4S  
A5-4S  
Use 1/2A6-4S for first flights.

BOOSTER  
1/2A6-0S A5-0S  
Use 1/2A6-0S for first flights.

Cat. No. 701-K-45  
**\$1.50**

### Astron AVENGER

Long slender lines give this bird the sounding rocket look. Two-stage design for high altitude flights. Large 18" chute brings payload section back gently booster employs tumble recovery.  
Pat. No. 3,292,302

#### Specifications

Length 32"  
(81.3cm)  
Body Dia 1.325"  
(33.7mm)  
Weight 2.7 oz.  
(77gr)  
Shipping wt 16 oz.

#### Recommended Engines

UPPER STAGE  
A5-4 B6-6  
C6-7  
Use B6-6 for first flights.

BOOSTER  
A8-0 B6-0  
B14-0 C6-0  
Use B6-0 for first flights.

Cat. No. 701-K-38  
**\$3.25**



**ADVANCED ROCKETEERS:** Single Stage  
Degree of Challenge: Two

The Cobra, Ranger, and the Cherokee-D are ideal kits to start with as you step up to advanced rocketry science. They give you experience with large engines and clustering. For information on engine clustering see page 74. All kits are parachute recovery. All three kits come complete, ready-to-build with instructions. Engines not included.

**Astron  
COBRA**

Ideal for your first cluster rocket (the use of more than one engine). The Cobra gives you top performance with medium size payloads (up to 4 oz.) in a 1" diameter capsule. Includes Tech Report on Clustering.

**Specifications**

Length	22.25"
	(56.5cm)
Body Dia	1.637"
	(41.6mm)
Weight	2.5 oz (71 gr)
Shipping wt	11 oz

**Recommended Engines**

Requires 3 identical engines at launch.

A8-3                      B6-4  
C6-5  
Use B6-4 for first flights.

Cat. No. 701-K-10  
**\$3.00**

**Astron  
CHEROKEE-D**

Big strong "D" engine rocket that will practically sail out of sight. 18" chute brings it down safely after flight. Pre-cut fins, quick-change engine mount, decal sheets. Beautiful kit.

**Specifications**

Length	21.6"
	(54.9cm)
Body Dia	1.325"
	(33.7mm)
Weight	2.75 oz (78 gr)
Shipping wt	11 oz

**Recommended Engines**

D13-6                      D13-7  
Use D13-7 for first flights.

Cat. No. 694-K-47  
**\$2.75**

**Astron  
RANGER**

Lift those BIG payloads off the pad with the powerful Astron Ranger. Perfect for launching and recovering those special instruments and specimens. Includes Tech Report on Clustering. 2' chutes.

**Specifications**

Length	24" (61cm)
Body Dia	1.637"
	(41.6mm)
Weight	3.4 oz (96 gr)
Shipping wt	13 oz

**Recommended Engines**

Requires 3 identical engines at launch.

A8-3                      B6-4  
C6-5  
Use B6-4 for first flights.

Cat. No. 701-K-6  
**\$3.00**



**ADVANCED ROCKETEERS:** Single Stage  
**Degree of Challenge:** Three

Astron  
STARLIGHT

Astron  
SCRAMBLER

The Scrambler and the Starlight offer the advanced rocketeer more challenge and satisfaction in building and flying. Parachute recovery. Both kits come complete, ready-to-build with instructions. Engines not included.

**Astron  
STARLIGHT**

An easy-to-build but advanced design with large fin area for exceptional stability. Launches straight up to extreme altitudes. Great for sport, or demonstration flying. You'll be proud to display this unusual bird.

**Specifications**

Length	18" (45.7cm)
Body Dia	0.976" (24.8mm)
Weight	2 oz (57 gr)
Shipping wt	9 oz

**Recommended Engines**

1/2A6-2      A8-3  
 B6-4      C6-5  
 Use A8-3 for first flights.

Cat. No. 681-K-32

**\$2.35**

**Astron  
SCRAMBLER**

Huge see-through payload section holds an egg or any other large payload . . . engine cluster design gives the power to boost it. Can carry an egg to over 1000 feet and gently set it down. Two chutes. Decals. Includes Tech Report on clustering.

**Specifications**

Length	23.5" (59.7cm)
Body Dia	1.637" (41.6mm)
Payload Dia	1.796" (45.6mm)
Weight	2.8 oz (79 gr)
Shipping wt	13 oz

**Recommended Engines**

Requires 3 identical engines at launch.

A8-3      B6-4  
 C6-5      B14-5  
 Use B6-4 for first flights.

Cat. No. 701-K-37

**\$4.25**





**ADVANCED ROCKETEERS:** Single Stage  
**Degree of Challenge:** Three

While these rockets require only average construction skills, they are some of the most impressive kits in the Estes line. Unusually good performance for seasoned rocketeers. Parachute recovery (except the Gyroc). All kits come complete, ready-to-build with instructions. Engines not included.

#### Astron GYROC

An amazing and unique "helicopter" recovery system makes the Gyroc a must for your fleet. Unusual appearance.

#### Specifications

Length	9.8" (24.9cm)
Body Dia	0.736" (18.7mm)
Weight	0.6 oz (17 gr)
Shipping wt	5 oz

#### Recommended Engines

1/2A6-2	A8-3
B6-4	C6-5

Use 1/2A6-2 for first flights.

Cat. No. 671-K-24  
**\$1.25**

#### Astron STAR BLAZER

Real space ship look with its forward crew cockpit canopy, structural fairing strips and streamlined fins.

#### Specifications

Length	12.5" (31.8cm)
Body Dia	0.736" (18.7mm)
Weight	1.0 oz (28 gr)
Shipping wt	5 oz

#### Recommended Engines

1/2A6-2S	A5-2S
A5-4S	

Use 1/2A6-2S for first flights.

Cat. No. 701-K-31  
**\$1.25**

#### Astron SPRINT

Highest performance in its class . . . up to 1600 ft. with C6-7 engine. Pre-cut fins, and tail cone. Decals included.

#### Specifications

Length	13.8" (35cm)
Body Dia	0.976" (24.8mm)
Weight	1.0 oz (28 gr)
Shipping wt	7 oz

#### Recommended Engines

1/2A6-2	A8-3
A5-2	B4-6
B6-6	C6-7
B14-5	

Use A8-3 for first flights.

Cat. No. 701-K-49  
**\$1.75**

Astron  
NIGHTHAWK

Astron  
FALCON

Astron  
SPACE PLANE

**ADVANCED ROCKETEERS:** Boost Gliders  
**Degree of Challenge:** Four

Glide recovery vehicles can be spectacular fun. The model launches straight up like a conventional rocket. At ejection either the balance of the model or the position of its aerodynamic surface is changed. Instead of streamlining straight down, the wings generate lift, pulling the nose up and the model goes into a glide. All kits come complete, ready-to-build with instructions. Engines not included.

**Astron  
NIGHTHAWK**

Revolutionary pop-pod system. Swish! Straight up for hundreds of feet... then pop! The power pod separates and drifts down by parachute...as the glide vehicle circles lazily against the sky. Pat. No. 3,452,471

**Specifications**

Length 19.75" (50.2cm)  
Body Dia 0.736" (18.7mm)  
Wing Span 16.25" (41.3cm)  
Weight (Complete) 1.4 oz (40 gr)  
Weight (Glider only) 0.7 oz (20 gr)  
Shipping wt 9 oz

**Recommended Engines**

1/2A6-2 A5-2  
B4-2  
Use A5-2 for first flights.

Cat. No. 701-K-34  
**\$2.00**

**Astron  
FALCON**

A fantastic glide recovery vehicle for experienced rocketeers. Front engine type. This bird will take the larger Estes engines and give you sky-high performance... boost glide times to over 1-1/2 minutes. Tech Report on Boost Gliders included. Patent No. 3,114,317

**Specifications**

Length 12" (30.5cm)  
Body Dia 0.736" (18.7mm)  
Wing Span 10" (25.4cm)  
Weight 0.4 oz (11 gr)  
Shipping wt 5 oz

**Recommended Engines**

1/4A3-1 1/2A6-2  
A5-2 B4-2  
Use 1/2A6-2 for first flights.

Cat. No. 651-K-13  
**\$1.00**

**Astron  
SPACE PLANE**

A historic duration winner and record holder. Rear engine type ascends vertically under rocket power, then glides safely back to earth. Features accurate glide adjustment; plus a payload section for small specimens. Tech Report on Boost Gliders included. Patent No. 3,157,960

**Specifications**

Length 10" (25.4cm)  
Body Dia 0.765" (19.4mm)  
Wing Span...9" (22.9cm)  
Weight 0.5 oz (14 gr)  
Shipping wt 5 oz

**Recommended Engines**

1/2A6-2 A5-2  
B4-2  
Use 1/2 A6-2 for first flights.

Cat. No. 651-K-3  
**\$1.80**





## ADVANCED ROCKETEERS: Multi-Stage

Degree of Challenge: Three

Estes' sophisticated two and three-stage rockets for experimental work and challenging fun flying for the expert. They represent the finest in model rocketry engineering and design. Parachute recovery. All kits come complete, ready-to-build with instructions. Engines not included.

### Astron APOGEE II

Ultimate in 2-stage performance and reliability. See-through payload section lets you observe specimens without removing them from the rocket. Includes Tech Report on Multi-Staging. Pat. No. 3,292,302.

#### Specifications

Length	14.7" (37.5cm)
Body Dia	0.736" (18.7mm)
Weight	0.6 oz (17gr)
Shipping wt	6 oz

#### Recommended Engines

##### UPPER STAGE

$\frac{1}{4}$ A3-4	$\frac{1}{4}$ A6-4
A5-4	A8-5
B4-6	B6-6
B14-7	C6-7

Use  $\frac{1}{4}$ A6-4 for first flights.

##### BOOSTER

$\frac{1}{4}$ A6-0	A8-0
B6-0	B14-0
C6-0	

Use  $\frac{1}{4}$ A6-0 for first flights.

Cat. No. 651-K-5

**\$2.00**

### Astron FAR SIDE (Two Models)

Sophisticated 3-stage ultra-high altitude probe or a workhorse vehicle for high altitude studies with large payloads. Top stage flies to well over 2500 feet. Choice of two models. Includes Tech Report on staging. Pat. No. 3,292,302.

#### Specifications

##### STANDARD MODEL (FAR SIDE)

Length	21.5" (54.6cm)
Body Diameter	0.976" (24.8mm)
Weight	2.0 oz (57gr)
Shipping wt	6 oz

##### LARGE PAYLOAD MODEL (FAR SIDE X)

Length	25" (63.5cm)
Body Diameter	1.637" (41.6mm)
Weight	2.5 oz (71gr)
Shipping wt	12 oz

#### Recommended Engines

##### FIRST STAGE

$\frac{1}{4}$ A6-0	B14-0	A8-0
--------------------	-------	------

Use B14-0 for first flights.

##### SECOND STAGE

$\frac{1}{4}$ A6-0	A8-0	B6-0
B14-0	C6-0	

Use  $\frac{1}{4}$ A6-0 for first flights.

##### TOP STAGE

$\frac{1}{4}$ A6-4	A8-5	B4-6
B6-6	B14-6	C6-7

Use  $\frac{1}{4}$ A6-4 for first flights.

Cat. No. 651-K-12  
(Std. Model)

**\$2.75**

Cat. No. 701-K-12X  
(Large Payload)

**\$3.75**



## ADVANCED ROCKETEERS: Multi-Stage

Degree of Challenge: Three

Big, sleek rockets designed primarily to carry the Estes photographic equipment. The Omega is designed for the Cineroc.

### Astron OMEGA

The ultimate in big engine performance blasts off heavy payloads such as the Cineroc movie camera (camera not included). Simplified pop-and-go staging.

#### Specifications

With Payload Section (and nose cone)	
Length	30.5" (77.5cm)
Body Dia	1.637" (41.6mm)
Weight	4.0 oz (113 gr)
Shipping wt	15 oz

#### Without Payload Section (or nose cone)

Length	19.0" (48.3cm)
Body Dia	1.637" (41.6mm)
Weight	2.6 oz (74 gr)
Shipping wt	14 oz

#### Recommended Engines

Booster: D13-0  
Upper Stage: D13-7  
Single Stage Flights: D13-5  
Use D13-5 for first flights.

Cat. No. 701-K-52P  
(with payload sec.)  
**\$5.00**

Cat. No. 701-K-52  
(without payload sec.)  
**\$3.50**

### Astron DELTA

Recommended 2-stage booster for Camroc rocket camera (camera not included). Can be flown either single or two stage. Accommodates all BT-50 size payload sections and nose cones. Advance stage coupling for top dependability. Includes Tech Report TR-2. Nose cone not included.

#### Specifications

Length	13.6" (34.5cm)
Body Dia	0.976" (24.8mm)
Weight	1.5 oz (43 gr)
Shipping wt	6 oz

#### Recommended Engines

##### SINGLE STAGE FLIGHTS

A8-3	B6-4
B14-5	B14-6
C6-5	

##### MULTI-STAGE FLIGHTS

Booster	
B6-0	B14-0
Upper Stage	
B6-6	B14-6
B14-7	C6-7

(For regular payload use only. See page 54 for engines recommended for use with Camroc)

Cat. No. 701-K-16  
**\$2.25**





**ADVANCED ROCKETEERS:** Scale Models  
**Degree of Challenge:** Two (WAC Corporal and Sandhawk)  
 Three (V-2 and Aerobee 300)

These scale models are easy enough for the average rocketeer to build, yet interesting enough for the most experienced. Parachute recovery gives gentle landings flight after flight. All kits come ready to assemble with instructions. Engines not included.

#### AEROBEE 300

Here is a beautiful, high-flying reproduction of the Aerobee 300 a famous sounding rocket. It was used in a great many space experiments during the 1950's and 1960's.

#### Specifications

Length 20"  
 (50.8cm)  
 Body Dia 0.976"  
 (24.8mm)  
 Weight 0.9 oz  
 (26 gr)  
 Shipping Wt 14 oz

#### Recommended Engines

1/2A6-2 B6-4  
 A8-3 C6-5  
 Use A8-3 for first flights.

Cat. No. 651-K-17  
**\$2.00**

#### NEW SANDHAWK

An ultra detailed 2½' tall scale model. Features all plastic fins, tail assembly, nose cone and payload section. Recovery is dual parachute type.

#### Specifications

Length 30.1"  
 (76.5 cm)  
 Body Dia 1.325"  
 (33.7 mm)  
 Weight 5 oz  
 (14.2 gr)  
 Shipping Wt 11 oz

#### Recommended Engines

B4-2 C6-3 D13-5

Use D13-5 for first flights. Use EM2050 adapter for other than "D" engines (adapter not included).

Cat. No. 711-K-51  
**\$3.25**

#### V-2

This is a scale model of the rocket that opened the door to the space age. It was the first to solve the problems of propulsion and guidance.

#### Specifications

Length 11.2"  
 (28.4cm)  
 Body Dia 1.325"  
 (33.7mm)  
 Weight 1.4 oz  
 (40 gr)  
 Shipping Wt 7 oz

#### Recommended Engines

1/2A6-2 A8-3  
 B6-4 B14-5  
 C6-5  
 Use B6-4 for first flights.

Cat. No. 701-K-22  
**\$2.00**

#### WAC CORPORAL

A high flying scale model...easy enough for the novice to build yet interesting enough for the experienced rocketeer. Tech report on stability included.

#### Specifications

Length 11.8"  
 (30cm)  
 Body Dia 0.736"  
 (18.7mm)  
 Weight .7 oz  
 (20 gr)  
 Shipping Wt 5 oz

#### Recommended Engines

1/2A6-2 A8-3  
 B6-4 C6-5  
 Use 1/2A6-2 for first flights.

Cat. No. 651-K-11  
**\$1.50**

#### Replacement

#### Plastic Parts Kit: (SANDHAWK ONLY)

Includes tail section, fins, payload section, nose cone and antennae.

Cat. No. 711-PRP-51

**\$1.35**



THOR  
AGENA-B

APOLLO  
SPACE CAPSULE

HONEST  
JOHN

ARCAS

**ADVANCED ROCKETEERS:** Scale Models  
**Degree of Challenge:** Four

These detailed scale models of famous actual rockets offer more challenge in building and flying. Handsome models you'll be proud of . . . to fly or display. Parachute recovery. All kits come complete ready-to-build with instructions. Engines not included.

**THOR  
AGENA-B**

A flying scale model of the launch vehicle for the Discoverer Program. Clear plastic fins stabilize flight, without detracting from appearance.

**Specifications**

Length 17.25"  
(43.8 cm)  
Body Dia 1.637"  
(41.6 mm)  
Weight 2.2 oz  
(62 gr)  
Shipping wt 12 oz

**Recommended  
Engines**

A8-3 B6-4  
C6-5  
Use B6-4 for first  
flights.

Cat. No. 701-K-28  
**\$3.25**

**APOLLO  
SPACE CAPSULE**

Precisely detailed. Built for flying with Saturn 1B and Little Joe II kits. Also makes a beautiful display kit.

**Specifications**

Length 6.6"  
Weight (Average) 0.36 oz.  
(10.2 gr)  
Shipping wt 5 oz

Cat. No. 681-NCK-29  
**\$1.75**

**HONEST  
JOHN**

A beautiful scale model of the U.S. Army's surface-to-surface ballistic missile. An historic rocket for your display shelf.

**Specifications**

Length 13.75"  
(35cm)  
Body Dia 0.976"  
(24.8mm)  
Wt 1.2 oz. (34 gr)  
Shipping wt 7 oz

**Recommended  
Engines**

1/2A6-2 A8-3  
A5-4 B6-4  
C6-5  
Use A8-3 for first  
flights.

Cat. No. 671-K-27  
**\$2.00**

**ARCAS®**

A precise reproduction of the famous ARCAS® sounding and meteorological rocket.

**Specifications**

Length 22.8"  
(58cm)  
Body Dia 1.325"  
(33.7mm)  
Wt 1.4 oz (40gr)  
Shipping wt 11 oz

**Recommended  
Engines**

A5-2 A8-3  
B6-4 C6-5  
Use A8-3 for first  
flights.

Cat. No. 701-K-26  
**\$2.25**



**ADVANCED ROCKETEERS:** Scale Models  
**Degree of Challenge:** Four

Spectacular on the ground and in the air, these kits require the experience of the advanced rocketeer. Both kits come complete with detailed instructions. Engines not included. Parachute recovery.

**SATURN V (Semi-Scale)**

Though not fully detailed this model of the Saturn V is an amazingly good representation of our nation's largest launch vehicle that put the first man on the moon. Scaled 1 to 242 it is a practical size to build.

**Specifications**

Length	18.1" (46cm)
Body Dia	1.637" (41.6mm)
Weight	1.9 oz (54 gr)
Shipping wt	12 oz

**Recommended Engines**

A8-3                      B6-4  
C6-5  
Use A8-3 for first flights.

Cat. No. 701-K-39  
**\$3.50**

**GEMINI-TITAN**

This is a semi-scale model of the rocket that first took America's two-man astronauts into orbit. This kit features clear plastic fins for stability. Use 12v car battery and Estes FS 5 Launch Control System for dependable ignition. Includes Tech Report on engine clustering.

**Specifications**

Length	24.4" (62cm)
Body Dia	2.217" (56.3mm)
Weight	3.8 oz (108 gr)
Shipping wt	1 lb., 3 oz

**Recommended Engines**

A8-3                      B6-4  
C6-5  
Use B6-4 for first flights.

Cat. No. 701-K-21  
**\$5.25**



**ADVANCED ROCKETEERS:** Scale Models  
**Degree of Challenge:** Five

Here are two thrilling scale models that give real challenge to building and flying skills of even the most experienced rocketeer. Both kits lift-off under cluster power (Saturn V can also be flown with a single "D" power engine) . . . recovery with two 24" and one 12" parachutes. Use a 12v car battery and a 12v Estes FS-5 Launch Control System. Authentic full color decals, detailed building and flying instructions. Engines not included.

**SATURN V**

A truly magnificent scale reproduction of our most famous rocket . . . the mighty Saturn V. Scaled 1/100th of its actual size, the model stands 43 3/4" tall. Precision molded plastic tower and engine nozzles, give detailed authenticity. Includes Tech Report on engine clustering.

**Specifications**

Length	43.5" (110cm)
Body Dia	3.938" (100mm)
Weight	9.9 oz (280 gr)
Shipping wt	3 lbs., 5 oz

**Recommended Engines**

May be flown as 3 engine cluster or single "D" engine

Cluster Power: (3 required) C6-3  
 "D" Power: D13-3 (1 required)

Cat. No. 701-K-36  
**\$13.50**

**SATURN 1B**

This is a completely detailed model of the rocket that first lofted the lunar module on its first flights in earth orbit. Great performance from the clustering of four engines. A real beauty, both in the air and on the ground. Includes Tech Report on engine clustering.

**Specifications**

Length	37" (94cm)
Body Dia	3.938" (100mm)
Weight	9.9 oz (280 gr)
Shipping wt	3 lbs., 5 oz

**Recommended Engines**

A8-3 86-4  
 C6-5  
 (4 engines required. All must be the same.)

Cat. No. 701-K-29  
**\$10.95**





## ADVANCED ROCKETEERS: Scale Models

Degree of Challenge: Five

These kits are exact scale models of two rockets that have played key roles in the exploration of space. Both great for display and flying. Parachute recovery. Come complete ready-to-build with detailed instructions. Engines are not included.

### LITTLE JOE II

As the first test vehicle for the Apollo mission, the contribution of Little Joe II is significant in NASA's lunar exploration program. Capsule and booster return on separate parachutes.

#### Specifications

Length	14.5"	(36.8cm)
Body Dia	2.217"	(56.3mm)
Weight	2 oz	(57 gr)
Shipping wt		16 oz

#### Recommended Engines

A5-2	A8-3	C6-5
B4-2	B6-4	
Use B4-2 for first flights.		

Cat. No. 701-K-30  
\$3.25

### MERCURY REDSTONE

The Mercury Redstone is the vehicle that boosted Commander Alan Shepard on America's first manned space flight. Beautiful kit scaled 1 to 42.

#### Specifications

Length	23.5"	(59.7cm)
Body Dia	1.637"	(41.6mm)
Weight	2.1 oz	(60 gr)
Shipping wt		12 oz

#### Recommended Engines

A8-3	C6-5
B6-4	
Use B6-4 for first flights.	

Cat. No. 701-K-41  
\$3.50



## ADVANCED ROCKETEERS: Exotic Designs of the Future

**Degree of Challenge:** Two (Saros)  
Three (Interceptor)

These brand new kits are long, sleek and futuristic. Spectacular in the air, beautiful on the ground. Highly detailed plastic parts virtually eliminate the need for sanding and filling. Gigantic decal sheets with the Interceptor give you beautiful detailing. Parachute recovery. Both kits come complete ready-to-build with instructions. Engines not included.

### SAROS

An excellent scale-like model for any rocketeer. A new feature is the integral fin unit-engine mount providing immediate and positive location of the thrust rings. The embossed metallic press-on material and decal arrangement add the final professional touch of realism not found in other models in its class.

#### Specifications

Length	22.5" (57.2cm)
Body Dia	0.976" (24.8mm)
Weight	1.5 oz (43 gr)
Shipping wt	8 oz

#### Recommended Engines

A8-3                      B6-4  
A8-5                      C6-5  
B4-4  
Use A8-3 for first flights.

Cat. No. 711-K-54                      **\$2.95**

#### Replacement Plastic Parts Kit

Includes nose cone, adapter and fin unit.

Cat. No. 711-PRP-54                      **\$1.50**

### INTERCEPTOR

This is the spectacular model featured on the catalog cover. The most colorful and exciting Estes Rocket ever! Carefully detailed plastic wing pods, nose cone, and tail cone. Two huge decal sheets.

#### Specifications

Length	26" (66cm)
Wing Span	7.4" (18.8cm)
Body Dia	1.325" (33.6mm)
Weight	3.85 oz (109 gr)
Shipping wt	12 oz

#### Recommended Engines

B4-2                      B6-4                      C6-5  
Use B6-4 for first flights.

Cat. No. 711-K-50                      **\$4.95**

#### Replacement Plastic Parts Kit

Includes nose cone, 2 wing pods and tail cone.

Cat. No. 711-PRP-50                      **\$1.35**



The Interceptor is featured on the catalog cover.



ORBITAL  
TRANSPORT

Astron  
TRIDENT

MARS  
SNOOPER

MARS  
LANDER

**ADVANCED ROCKETEERS:** Exotic Designs  
**Degree of Challenge:** Four

Here are the models designed to give Estes rocketeers a look into the future. Parachute recovery. Kits complete with instructions. Engines not included.

**ORBITAL  
TRANSPORT**

Spectacular flight. Showpiece on the ground. Based on latest proposals for a reusable air breathing (Scramjet) booster for orbital vehicles. Transport lifts off under rocket power. At ejection the re-entry vehicle separates and glides back to earth. See page 14.

**Specifications**

**BOOSTER**  
Lgth 23" (58.4cm)  
Body Dia 0.976"  
(24.8mm)  
Wing Span 7.9"  
(20cm)  
Weight 2 oz (57gr)  
**RE ENTRY VEHICLE**  
Lgth 8.6" (21.8cm)  
Body Dia 0.736"  
(18.7mm)  
Wing Span 5"  
(12.7cm)  
Weight 0.5 oz (14 gr)  
Shipping wt. 16 oz

**Recommended  
Engines**

B6-4 C6-5  
Use B6-4 for first  
flights.

Cat. No. 701-K-42  
**\$3.25**

**Astron  
TRIDENT**

Futuristic rocket design introduces ejection ducting. This system directs ejection gases through openings in the power tube into three ducting tubes to pressurize the parachute compartment for deployment of the chute.

**Specifications**

Length 31.6"  
(80.3cm)  
Main Body Dia 0.976"  
(24.8mm)  
Weight 2.7 oz  
(77 gr)  
Shipping wt. 11 oz

**Recommended  
Engines**

A8-3 B6-4  
C6-5 B14-5  
Use B6-4 for first  
flights.

Cat. No. 681-K-35  
**\$4.00**

**MARS  
LANDER**

Authentic, futuristic concept in a planetary exploration vehicle. Lands upright on spring loaded gear after parachute recovery. Highly detailed body panels with colorful decal sheets.

**Specifications**

Height 12"  
(30.5cm)  
Body Dia 3.8"  
(96.5mm)  
Landing Gear Span 13.2"  
(33.5cm)  
Weight 3.0 oz  
(85 gr)  
Shipping wt. 16 oz

**Recommended  
Engines**

B4-2 C6-3  
Use B4-2 for  
first flights.

Cat. No. 701-K-43  
**\$6.00**

**MARS  
SNOOPER**

A truly different model combines unique appearance with reliable performance. Great for show or demonstration flying. Payload section, 18" chute and pre-cut fins for easy assembly. Especially recommended for the careful modeler.

**Specifications**

Length 21.7"  
(55.1cm)  
Body Dia 0.976"  
(24.8mm)  
Weight 2.2 oz  
(62 gr)  
Shipping wt. 8 oz

**Recommended  
Engines**

A8-3 B6-4  
C6-5  
Use B6-4 for first  
flights.

Cat. No. 701-K-20  
**\$3.25**





Astron  
SPACEMAN

Astron  
PHANTOM

Astron  
BIRDIE

## SPECIAL PURPOSE MODEL ROCKETS

Degree of Challenge: One (Birdie and Phantom)  
Three (Spaceman)

These unusual kits are great for a "change of pace". Something different for showing and flying. The Phantom is of particular interest for science classes and fairs.

### Astron SPACEMAN

Great for demonstrating that a rocket doesn't always have to look like a rocket to fly well. Requires a little patience and artistic ability to build. Uses the feather-weight recovery system... no parachute.

#### Specifications

Length 7.25" (18.4cm)  
Width 4" (10.1cm)  
Weight 0.5 oz (14 gr)  
Shipping wt 6 oz

#### Recommended Engines

1/2A6-2 A5-4  
B4-4 B6-6  
C6-7  
Use 1/2A6-2 for first flights.

Cat. No. 651-K-9  
.75

### Astron PHANTOM

This bird will never fly, but it makes a great demonstration model. The transparent body shows all of the structural insides of a model rocket ...even a special dummy engine cut in half. Great for answering rocketry questions.

#### Specifications

Length 8.7" (22cm)  
Body Dia 0.736" (18.7mm)  
Weight 0.7 oz (20 gr)  
Shipping wt 4 oz

Cat. No. 651-K-7  
\$1.75

### Astron BIRDIE

You can change a badminton "bird" to a rocketeer's "bird" with this unusual kit. Kit has everything you'll need...plastic shuttlecock body tube, engine block, adapter ring and launch lug. This really different kit is a "stopper".

#### Specifications

Length 2.8" (7.1cm)  
"Fin" Span 2.6" (6.6cm)  
Weight 0.303 oz (9 gr)  
Shipping wt 6 oz

#### Recommended Engines

1/4A3-2S  
1/2A6-2S  
Use 1/2A6-2S for first flights.  
Uses series III engines only.

Cat. No. 701 K-44  
.60



# the incredible CINEROC

MODEL ROCKET MOVIE CAMERA



The most important model rocket development in years, the Estes CINEROC enables the advanced rocketeer to make moving photographic studies from a vantage point never before possible: the rocket itself!

Fully loaded, the CINEROC weighs only 3 ounces, easily lofted by the Estes "D" engines. The Super-8mm camera is an engineering marvel. The single element 10mm acrylic lens gives the best possible image with the greatest depth of field. You'll see the launch lugs and fins of the launch vehicle as clearly as the terrain far below. A semi-slow motion effect is obtained with the CINEROC's exposure rate of 31 frames per second, ideal for studying ignition, booster separation, stability, and parachute opening actions.

An essential part of the CINEROC is the Flight-Pak film cartridge. No threading, just slip it into the camera and you're ready to go. See page 56 for processing information and information about ordering more Flight-Paks.

The photos at the left were taken from CINEROC films and show the clarity and detail possible. You see everything... from lift-off to deployment of the recovery system!

Completely assembled with Flight-Pak loaded with color film, 2 batteries, and 18" parachute. Shipping weight 1.5 lbs.

Cat. No. 701-CM-8 (less launch vehicle)  
\$ 19.95

**NOTE** The CINEROC, CAMROC, and the "D" engine rockets are recommended only for experienced rocketeers. First flights should be single stage.

## CAMERA SPECIFICATIONS

10mm focal length lens f11 —  
1/500 sec. shutter 31 frames per  
second 6" to infinity depth of  
field. Takes color film

Diameter: 1.75"

Length: 9.9"

Fits BT-60 Body Tube

## SUPER-8MM

Super-8mm film can only be shown on Super-8mm projectors — or this hand viewer from Estes! Crank fast for a quick flight or slowly for slow motion. Ideal for frame-by-frame analysis of your flight.

Shipping weight 12 oz.

Cat. No. 701-MV-8

**\$4.95**

## COMBINATION OFFER

The recommended launch vehicle for the CINEROC is the Astron Omega, a "D" engine bird specially designed to loft the CINEROC. (See page 35 for information regarding the Omega.) Now order the CINEROC and Omega together

Shipping weight 2 lbs., 4 oz.

Cat. No. 701-RC-8

**\$22.95**

## UNUSUAL ROCKETRY MOVIES

CINEROC movies shot by the Estes Research and Development Department. 50 feet of color film.

Super 8mm

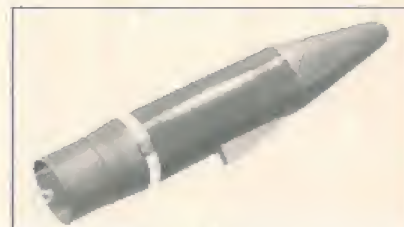
Cat. No. 711-MF-1S

**\$4.95**

Std. 8mm

Cat. No. 711-MF-1R

**\$4.95**





ONLY  
**\$4.75**

# CAMROC

## ROCKET CAMERA

Lens opening — 1 1/2  
Shutter speed — 1/1000  
Total Length 3" (75 mm)



Launch your own aerial rocket camera! The Camroc automatically takes a photograph from hundreds of feet in the air and then returns safely. Uses a single exposure film disc mounted in a light tight holder for quick and easy replacement in the field. Fits body tube BT-50. Negative is 1 1/2 inches in diameter. In kit form with all parts and instructions for assembly and operation: 1 film holder loaded with unexposed film, 1 empty film holder and exposed film disc for practice loading and experimenting. Shipping weight 7.5 oz.

Cat. No. 701-C-1 . . . . . **\$4.75**

### SPECIFICATIONS

Length . . . . . 5.3 in (13.5 cm)  
Body Dia . . . . . 1.637 in (41.6 mm)  
Weight . . . . . 1.3 oz (37 gr)

### RECOMMENDED ENGINES

Multi-Stage Flights  
Booster . . . . . Upper Stage  
B14 0 . . . . . B14 6, B14 7 C6 7  
Single-Stage Flights  
B14 5, B14 6 C6 7

## SPECIAL OFFER

**SAVE 50c**

Complete Camroc kit plus the Astron Delta kit shown on page 35. This gives you the best basic outfit for making aerial photos. Engines not included. Shipping wt. 14 oz.

Cat. No. 701-RC-1 . . . **\$6.50**



# CAMROC

OPENS NEW VISTAS TO  
THE ADVANCED  
ROCKETEER

Aerial photography has long been acknowledged for its value in map making, geographical studies, reconnaissance and related research fields. The Camroc aerial camera opens a new field of science studies to the rocketeer who wants to get a better understanding of the scientific uses of aerial photography. Recommended booster vehicle is the Delta. Other models can be adapted.

In addition to learning principles of camera construction and operation, many challenging aerial photographic projects can be developed.

Study space science reconnaissance techniques the practical way — over familiar terrain with known objects. Map your flight area with Camroc photos. Use photo pairs, which produce a stereoptic image when properly viewed, to emphasize geological features or estimate heights of different objects quite accurately.

Negative 1 1/2" dia.  
Print size 3" dia.



Processing  
information  
on page 56



# FILM PROCESSING & SUPPLIES

## CAMROC

Rocketeers who have access to a photographic darkroom can develop and print negatives from the Camroc with no difficulty. For those who would rather not do their own processing, Estes Industries offers developing and printing service. Prints produced are enlarged to twice the negative size. Recommended film is Estes Industries Astroman 400 or identical Kodak Tri-X. Both films are rated at A.S.A. 400 but pushed to A.S.A. 1200 in development. **IMPORTANT:** All Camroc film not in light-tight holders **MUST BE HANDLED IN TOTAL DARKNESS.**

### DEVELOPING-PRINTING

Film is developed under controlled conditions. One glossy print is made at 2 times enlargement (3" dia. image). A refund of \$ .20 will be made on any negative which does not meet the requirements for a satisfactory print. This can be caused by incorrect exposure or improper handling. In this case negative will be returned unprinted. We recommend sending your film for processing in its original container or other totally light-tight container.

Cat. No. 691-FDP-1 ..... \$ .50

### EXTRA PRINTS

You can order additional prints of negatives which have been previously developed. The negative(s) must be enclosed in a suitable protective package with the order. (Please do not order extra prints without first checking the negative and original print to determine if it is suitable for extra prints.)

Cat. No. 651-NP-1 ..... \$ .30 ea.

ALL PROCESSED NEGATIVES AND  
PRINTS ARE RETURNED BY AIR MAIL  
WHEN DISTANCE IS OVER 400 MILES

### CHANGING BAG

Light-tight "portable darkroom". Fits over operator's arms, provides total darkness for changing film in the field or reloading your own film holders. Shipping weight 8 oz.

Cat. No. 701-FCB-1 ..... \$1.75



### LOADED FILM HOLDERS

Extra film holders for in-the-field changing are available for the Camroc. They come 4 to an order, each pre-loaded with a fresh Astroman 400 film disc. Film holders may be returned with the film for processing. They are re-usable and subject to refund when returned as explained below. Shipping weight 2 oz.

Cat. No. 651-FFH-4 ..... 4 for \$2.00

#### REFUND PLAN ON FILM HOLDERS

A refund of \$ .15 will be allowed for all film holders returned to us in good re-usable condition. When returning film holders for any reason you may deduct \$ .15 for each holder returned. Unless you specifically request their return, all holders sent us will be automatically retained and the refund will be made or credit allowed.

### FILM ONLY

Precision cut Astroman 400 film discs to fit Camroc film holder. Packaged in light-proof double envelope. Envelope should be opened **ONLY IN TOTAL DARKNESS** to avoid ruining the film. Handling and loading instructions included. Shipping weight 1.5 oz.

Cat. No. 651-NF-6 ..... 6 for \$ .75

### FLIGHT-PAK PROCESSING

You'll want top quality processing of your Flight-Pak film! After exposure, place the Flight-Pak back in its black plastic bag, package it for safe mailing, enclose \$2.00, and send to:

Estes Film Lab  
3911 Sinton Road  
Colorado Springs, Colo. 80907

Cat. No. 701-FDP-2 ..... \$2.00

## CINEROC

### FLIGHT-PAK MOVIE CARTRIDGE

Cartridges contain 10 feet of Super-8mm color film for approximately 40 seconds of projection time. Two PFB-2 batteries (good for one flight) included with each cartridge. Shipping weight 4 oz.

Cat. No. 701-CFH-8 ..... \$4.00

# MODEL ROCKETRY TECHNICAL MANUAL

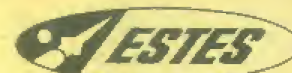
Welcome to the exciting world of model rocketry! This brief technical manual for model rocketeers was written to provide both an easy to-follow guide for the beginner and a handy reference volume for the experienced rocketeer. In the next few pages you'll find the answers to the questions most commonly asked by model rocketeers. More complete technical information on all the subjects covered can be found in the many publications listed in the current Estes catalog.

We hope this manual will help make model rocketry as exciting and enjoyable for you as it is for us.



### TABLE OF CONTENTS

YOUR FIRST ROCKET	Pg. 58
CONSTRUCTION TECHNIQUE	Pg. 60
FLYING YOUR MODEL	Pg. 65
STABILITY	Pg. 66
RECOVERY SYSTEMS	Pg. 69
MULTI-STAGING	Pg. 70
LAUNCHING	Pg. 72
CLUSTERING	Pg. 74
FINISHING	Pg. 76
TRACKING	Pg. 78
BOOST-GLIDE	Pg. 80
SAFETY	Pg. 82
ROCKET ENGINE DESIGN	Pg. 84
ENGINE CLASSIFICATION	Pg. 86
MODEL ROCKET PERFORMANCE MEASUREMENTS	Pg. 87



A SUBSIDIARY OF DAMON

Prepared by Vernon Estes  
and William Simon  
Gene Street, Illustrator

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P.O. Box 227, Penrose, Colo. 81240



# YOUR FIRST ROCKET

## BUILDING THE ASTRON ALPHA A TYPICAL MODEL ROCKET

The construction of the Astron Alpha is shown here both to give the beginning rocketeer plans for a good first model and to illustrate the way a typical model rocket is built. The assembly techniques used in this and other model rockets are explained in greater detail on the following pages.

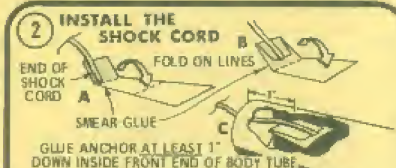
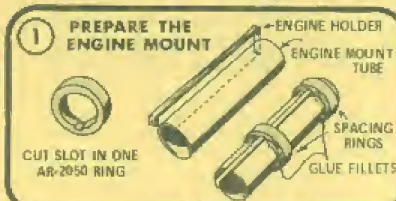
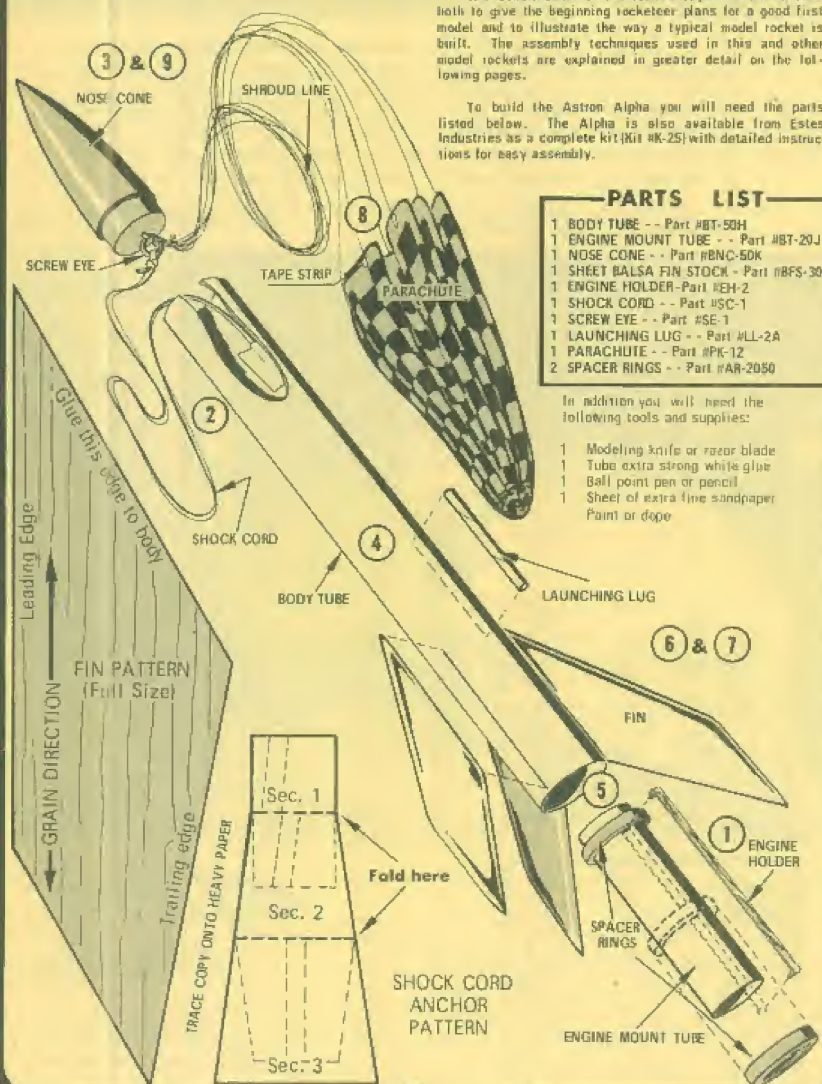
To build the Astron Alpha you will need the parts listed below. The Alpha is also available from Estes Industries as a complete kit (Kit #K-25) with detailed instructions for easy assembly.

### PARTS LIST

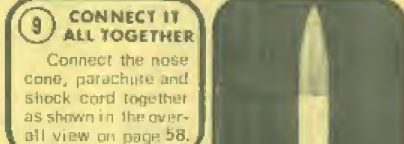
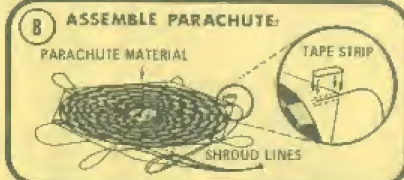
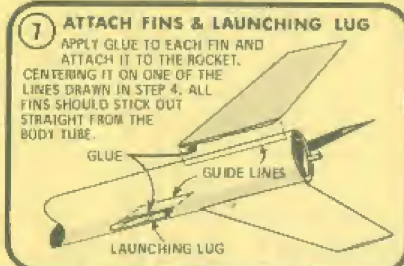
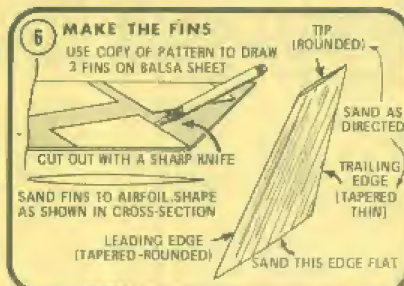
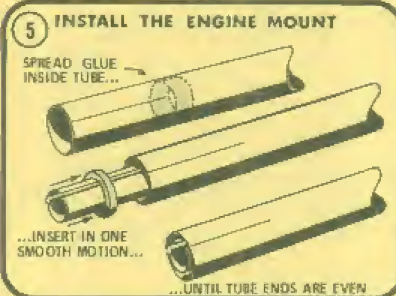
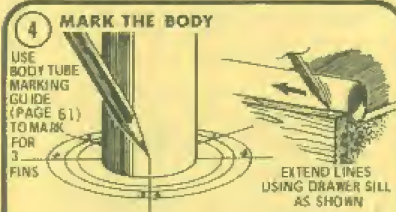
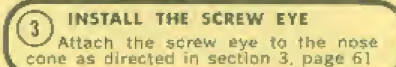
- 1 BODY TUBE -- Part #BT-50H
- 1 ENGINE MOUNT TUBE -- Part #BT-20J
- 1 NOSE CONE -- Part #NC-5DK
- 1 SHEET BALSA FIN STOCK -- Part #BFS-30
- 1 ENGINE HOLDER--Part #EH-2
- 1 SHOCK CORD -- Part #SC-1
- 1 SCREW EYE -- Part #SE-1
- 1 LAUNCHING LUG -- Part #LL-2A
- 1 PARACHUTE -- Part #PK-1Z
- 2 SPACER RINGS -- Part #AR-2050

In addition you will need the following tools and supplies:

- 1 Modeling knife or razor blade
- 1 Tube extra strong white glue
- 1 Ball point pen or pencil
- 1 Sheet of extra fine sandpaper
- Paint or dope



To absorb the shock of ejection and parachute opening a rubber cord connects the parachute and nose cone to the main rocket body. This shock cord must be securely attached to the body with an anchor as shown.



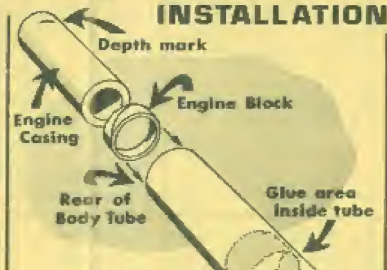


# CONSTRUCTION TECHNIQUES

## ① ENGINE MOUNTING METHODS

### ENGINE BLOCK

#### INSTALLATION



Some models use an engine block to keep the engine from traveling too far forward in the rocket body both when it is installed and when the rocket is launched.

When building a model, use an engine casing to press the engine block into position. After applying glue to the inside of the

tube, place the engine block just inside the rear of the body. Push the block forward into position with the engine casing in one smooth motion so the glue will not freeze the block in the wrong place.

When the mark on the engine casing is even with the rear of the body tube the block will then be in the correct position. Remove the engine casing immediately.

### FRICTION FIT



Masking tape

When mounting the engine in a model with an engine block, wrap the engine with masking tape until it will make a tight friction fit in the tube. Then slide the engine into place.

## ENGINE HOLDERS

In many models an engine holder is the best device to use for mounting an engine. The drawings show how engine holders are mounted for different sizes of rockets.



To mount an engine in a model with an engine holder, spring the end of the holder up and slide the engine into place. Check to make sure the end of the holder latches securely over the end of the engine.

#### REINFORCING GAUZE

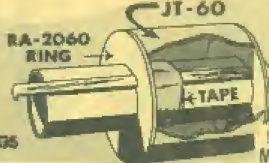


BT-20 MOUNT

BT-50 MOUNT

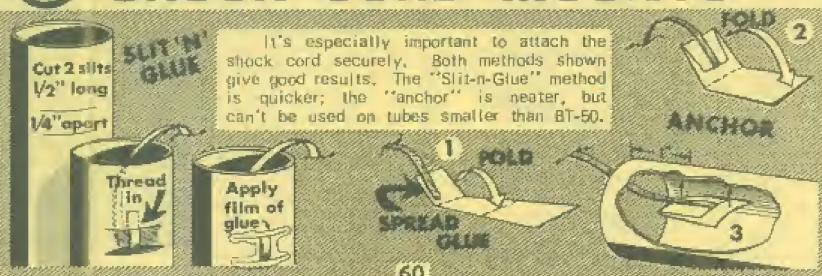


AR-2050 RINGS



BT-60 MOUNT

## ② SHOCK CORD MOUNTS



It's especially important to attach the shock cord securely. Both methods shown give good results. The "Slit-n-Glue" method is quicker; the "anchor" is neater, but can't be used on tubes smaller than BT-50.

## ③ SECURING A SCREW EYE

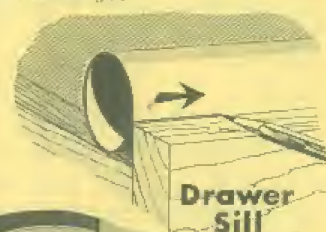
To avoid losing your nose cone, make sure the screw eye is securely attached. Make a hole by inserting and removing the eye. Squirt glue into the hole and replace the eye.



## ④ MARK THE BODY

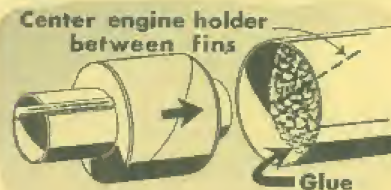


(B) When marking the body tube for fin alignment, use the "V" notch of a drawer sill or door frame as shown. Match the edge of the notch with a spacing mark; run a pencil along the edge to draw your guide line. When all three or four lines are drawn, glue the fins to the body on the lines and they will be straight.



(A) This Fin Spacing Guide will space equally three or four fins on all popular body tubes sold by Estes Industries. To space the fins, center the end of the tube in the circles, then mark at the (4) lines for four fins or on the (3) lines for three fins. Draw lines from these marks as shown in the drawings at right.

## ⑤ INSTALL THE ENGINE MOUNT



It's best to draw the fin alignment lines on the body *before* installing the engine mount. Position the mount so the engine holder is midway between two fin lines for easier operation. First make sure the mount slides easily in the body tube. If it's tight, sand it until it does slide easily. Smear a liberal amount of glue around the inside of the body over the area where the mount's rings or coupler will fit. Insert the mount into position in one smooth motion. DON'T pause, or the glue will "grab" with it in the wrong place. Support the tube "nose-up" while the glue dries.



## ⑥ MAKE THE FINS

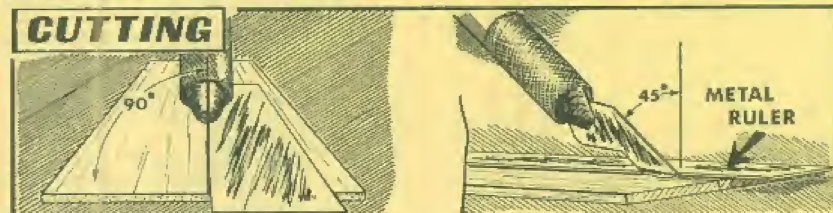
### MARKING



Model rocket fins are almost always made from thin sheets of balsa wood. When making fins, always be sure the grain of the wood is parallel to the leading edge of the fin.

Draw a full-size fin pattern on stiff paper or cardboard. Cut out the pattern, position it on the fin stock, and trace around it with a pencil or ball point pen to mark the balsa for each fin.

### CUTTING



Use a metal straightedge whenever possible. Hold knife or saw blade at 90° angle to surface being cut, & handle at about 45° for clean cut. If blade is dull or held too high balsa tends to tear.

### SHAPING



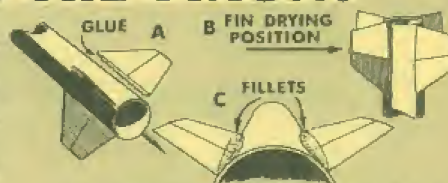
For general purposes, sand all edges round except the root edge (the edge that glues to the body). Make the root edge straight and square. The sides of the fins should be sanded smooth.

On high performance models try to sand the fins to the shape shown. The front (leading) edge of the fin should be slightly rounded; the back (trailing) edge should come to a knife edge.

## ⑦ ATTACHING THE FINS...

Always use a high-strength adhesive such as white glue for attaching fins. After marking the tube and sanding the fins, apply a line of glue to the root edge of a fin. Let it set a minute or two, then press it into place on the body tube. Attach the other fins in the same way. Support the rocket body in a vertical position while the glue dries.

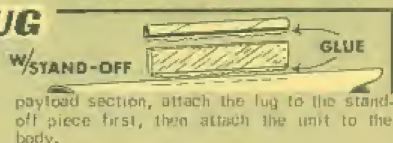
Sometime after the first glue on the fins has dried completely, the joints should be



reinforced. Do this by applying a "fillet" of glue as shown. Always support the body in a horizontal position while fillets are drying.

### ...and LAUNCHING LUG

Launch lugs are attached in much the same way as fins. If a stand-off is used to keep the rod from hitting a large diameter

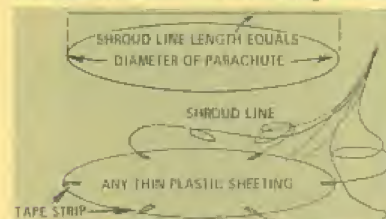


## ⑧ ASSEMBLE PARACHUTE

In addition to regular, pre-printed model rocket parachutes, a rocketeer can use a wide variety of thin plastic sheeting to slow his model's descent. When making a chute

it's often worthwhile to be able to quickly switch a parachute from one model to another or to replace a 'chute with a new one.

To install a snap swivel, simply gather the ends of the shroud lines and dampen them so as to form a fairly stiff "point," then thread this point through the eye of the snap

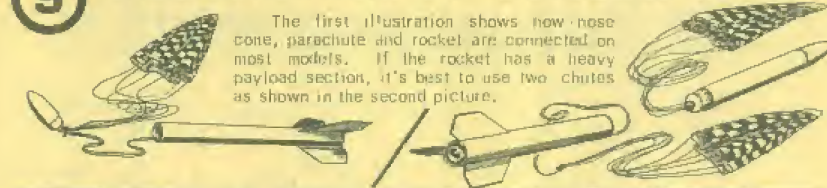


from "scratch," cut the plastic sheet to shape, then attach 6 or 8 shroud lines, each as long as the diameter of the parachute, as shown. Gather all the loose ends of the shroud lines and tie a knot at the extreme end of the group.



swivel as shown. Once through the eye the lines are tied together in a tight knot and pulled back against the eye. Apply a drop of glue to the knot.

## ⑨ CONNECTING IT TOGETHER



The first illustration shows how nose cone, parachute and rocket are connected on most models. If the rocket has a heavy payload section, it's best to use two chutes as shown in the second picture.

## ⑩ PAINT THE MODEL

Nothing does quite as much for the appearance of a model as a good paint job. Before the paint can go on, though, a lot of careful preparation should be done.



Make sure all glue fillets are smooth and have no air holes. If a fillet isn't right, apply another layer of glue and smooth it out with your finger tip.

### WOOD SEALING

All balsa surfaces should be "filled." To do this, apply a coat of sanding sealer, let dry completely, and sand with extra-fine (or finer) sandpaper. Apply another coat, let dry, and sand again. Continue this procedure until all the tiny holes (pores) in

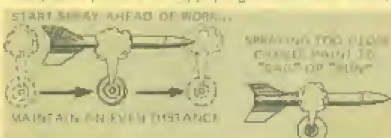
the wood are filled and the surface is perfectly smooth.

### ... BRUSH-ON PAINTS

If you use a brush, make sure the brush is clean. Old dope will mix with and discolor fresh dope. Dope can be thinned 50% for a smoother finish. Avoid "brushing over" as the surface sets rapidly. Unnecessary brushing can produce an uneven finish. Always let the paint dry completely between coats.

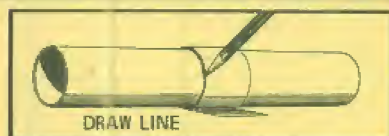
### SPRAYING...

Spray paints will give the beginner a better than average finish. Apply spray paint in light, even coats. Let each coat dry completely before applying the next coat.





Many models call for special lengths of body tubes; the rocketeer has to cut the tube himself to build the rocket. Here's how to get a neat cut every time.



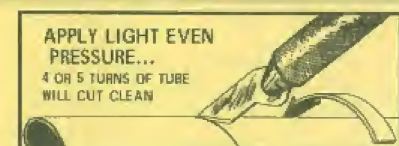
(1) Mark the tube at the point where the cut is to be made. Wrap a straight strip of paper around the tube and align the edge with the mark. Draw a line completely around the tube.



(2) Slide a stage coupler into the tube—center it under the cut position to support the tube.

(3) Cut lightly along the line, rotating the tube as you cut. Use a sharp blade but

## CUTTING TUBES



don't try to cut all the way through on the first turn. Use a light pressure on the knife for several turns until you cut through.

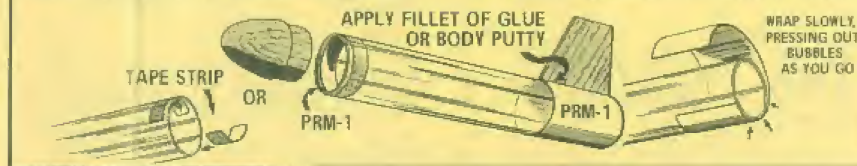


(4) Slide the stage coupler into the cut end of the tube. Hold the tube near the cut end and work it over a flat sheet of very fine sandpaper with a circular motion as shown to remove burrs and rough edges.

## MYLAR BODIES

BT-10 is an ultra-light mylar plastic tube which is recommended for use with the featherweight recovery system. It will withstand the heat of an ejection charge only

when the engine is ejected from the rocket body by the charge. Paper reinforcing material must be used to glue parts to the tube, as ordinary glues will not stick to mylar.

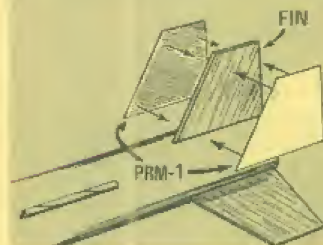


## REINFORCING FINS

When a model is built to be flown many times, it's often wise to strengthen the fins. The easiest way of doing this is to use self-adhesive paper reinforcing material (PRM-1).

Cut out two "mirror-image" pieces of reinforcing material for each fin. Peel off the backing and apply one piece to each side of the fin. Rub the reinforcing down on both sides so it is securely attached, then seal around the edges with white glue.

Fins reinforced in this manner give up to four times the strength of plain balsa wood with only a little more weight.

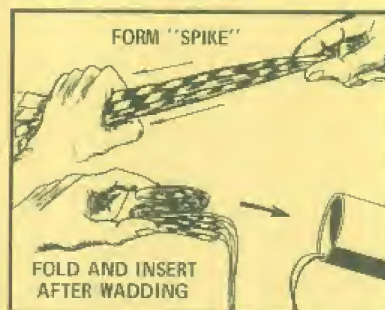


## FLYING YOUR MODEL

### Preparing for Flight

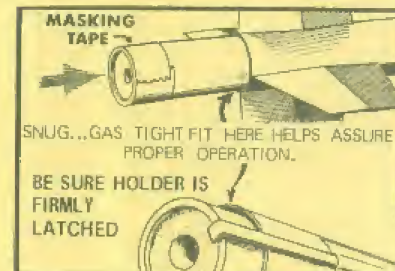


Parachutes and streamers must be protected from the heat of the ejection charge. This protection is supplied by first loosely packing enough flameproof recovery wadding into the tube to fill it for a depth of at least twice the body diameter. The wadding should fit against the side of the tube all the way around to give a good seal.



To fold the parachute, hold it between two fingers at its center and pass the other hand down it to form a "spike" shape. Fold this spike tightly into several sections as shown. Push the folded 'chute down into the tube on top of the wadding. Pack shroud lines and shock cord in on top of the 'chute, then slide the nose cone into place.

To activate streamer or parachute recovery gear correctly, the engine **MUST** be held in place **SECURELY**. This may be done by wrapping the nozzle end of the engine with tape until it makes a snug fit in the body tube or engine mount.



On models using engine holders, make sure the end of the holder latches securely over the end of the engine.

## Countdown Checklist

Use a countdown check list when you launch your models. You'll find it makes your rocket flights more successful and enjoyable. The following procedure is recommended for most 'chute or streamer models. For other types of rockets, try to develop your own complete check list.

12) Pack flameproof recovery wadding into the body tube. Insert the parachute or streamer.

11) Install the nose cone or payload section. Check condition of the payload (if any).

10) Apply enough masking tape to the engine(s) for a tight friction fit in the body tube(s). When launching a multi-stage rocket

be sure that the engines are in their proper relative positions and that a layer of cellophane tape is wrapped tightly around each engine joint. Mount the engine in the rocket.

9) Install a nichrome igniter in the engine.

8) Place the rocket on the launcher. Clean and attach the micro-clips.

7) Clear the area, check for low flying aircraft, alert recovery crew and trackers.

6) Arm the launch panel.

5) 4) 3) 2) 1) LAUNCH!



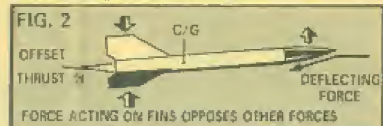
# STABILITY

One of the first things a model rocket designer learns is that a vehicle will not fly unless it is aerodynamically stable. By stable we mean that it will tend to keep its nose pointed in the same direction throughout its upward flight. Good aerodynamic stability will keep the rocket on a true flight path even though some force (such as an off-center engine) tries to turn the model off course.

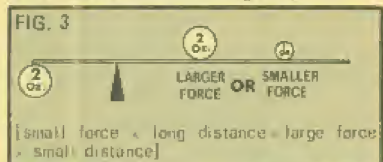
If a model is not stable, it will constantly turn its nose away from the intended flight path. As a result, it will try to go all over the sky, but end up going 'nowhere.' An unstable rocket will usually tumble to earth after the engine burns out, damaging the model.



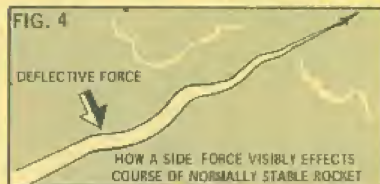
When a free-flying object rotates, it always rotates around its balance point. (The proper term for the balance point is the center of gravity, abbreviated as C.G.) Thus the balance point (C.G.) is the pivot for all forces trying to turn the rocket.



The most significant forces acting on a model rocket in flight are caused by the thrust of the engine, the action of air on the nose and the action of air on the fins. Off-center thrust and the forces on the nose try to bring the nose of the rocket around to the rear. They are opposed by the forces acting on the fins. All these forces are amplified by the distance from the location of the force to the center of gravity.

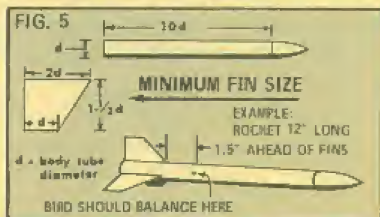


As long as the forces on the fins of the rocket are great enough to counteract the forces on the nose and any off-center thrust, the rocket will fly straight. If the fins are too small and/or too close to the center of gravity, there will not be enough force to counteract the force on the nose. As a result, the nose will swing out to the side and the model will try to chase itself around the sky.



The side forces on the nose and fins of a rocket that is flying straight are very small. When something disturbs the rocket and it starts to turn sideways, the side forces on both nose and tail increase. (There is some aerodynamic force on the body; however, it is small and can usually be ignored.) Depending on the size and shape of the nose and fins and their distances to the center of gravity, one will overpower the other and force the rocket to turn its way. If the nose overpowers the fins, it's too bad. However, if the fins overpower the nose, the rocket will swing back into line and continue on its way.

Although determining the exact relationships between various forces on a model rocket requires higher mathematics, certain practical rules can be used by even the beginning rocketeer to design stable rockets. The first rule is to use a long body. Until you have considerable experience in designing models, the length of the body tube used should be at least 10 times its diameter. This makes it easier to get enough distance between the center of gravity and the fins.



The second rule is to make the fins large. The larger the fins, the more force they will produce when the rocket starts to turn. For the first few designs, use a fin which is at least as large as the example in the illustration.

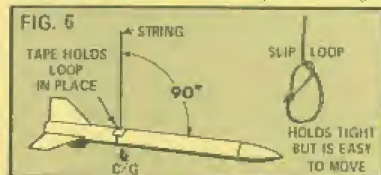
The third rule is to place the fins as far back on the rocket as possible. Generally, this means that the rear edge of the fin will meet the rear end of the body and the fin will be swept back. Do not place any fins ahead of the center of gravity.

Finally, the rocket should balance at least 1/8 its length ahead of the front of the fins. This gives the fins the leverage they will need to counteract the force on the nose.

Remember that these rules are general; they are based on experience rather than precise mathematical analysis. By using more exact methods (See TR-1 and TR-9) it's possible to build rockets with less stability margin. In any event, always remember to test your model for stability before you launch it.

## Testing for Stability

The easiest way of testing the stability of a model is to fly it—without launching it. This is done by attaching a string to the model and swinging it through the air. If the string is attached at the rocket's CG, its behavior as it is swung through the air will indicate what it will do in powered flight.

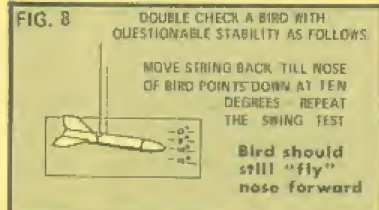


Make the test on your model by forming a loop in the end of a six to ten foot string. Install an engine in the rocket. (The center of gravity is always determined with an engine in place.) Slide the loop to the proper position around the rocket so the model balances horizontally. Apply a small piece of tape to hold the string in place.



With the rocket suspended at its center of gravity, swing it overhead in a circular path. If the rocket is very stable, it will point forward into the wind created by its own motion. Some rockets which are stable will not point forward of their own accord unless

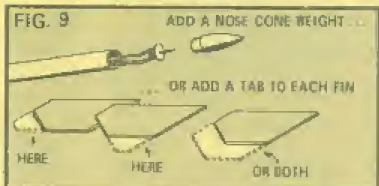
they are started straight. This is done by holding the rocket in one hand with the arm extended and then pivoting the entire body as the rocket is started in the circular path. It may take several attempts before a good start is achieved.



If it is necessary to hold the rocket to start it, an additional test should be made to determine whether the model is stable enough to fly. Move the loop back on the body until the tube points down at a 10° angle below the horizontal. Repeat the swing test. If the model will keep its nose pointed ahead once started, it should be stable enough to launch.

Be careful when swinging a rocket overhead: A collision with a nearby object or person could be serious. Always do your testing in an open, uncluttered area.

Don't try to fly a rocket that has not passed the test. Most unstable rockets loop around in the air harmlessly. However, a few marginally unstable models will make a couple of loops and then become stable due to the lessening of the propellant load. When this happens, the model can crash into the ground at high speed. A person standing in the wrong place could get hurt.



If your rocket does not pass the stability test, it can usually be made stable. Two methods can be used: The balance point can be moved forward or the fins can be enlarged. To move the balance point forward, attach nose cone weights to the base of the nose cone. Fins can either be replaced with larger ones or extra tabs can be glued to the rear or tip edges of the fins. (Some scale models use supplementary plastic fins.) After making your changes, test the model again to be sure it is now stable.

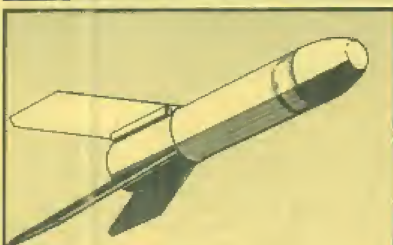


# RECOVERY SYSTEMS

The recovery system is one of the most important parts of a model rocket. It is designed to provide a safe means of returning the rocket and its payload to earth without damaging the rocket or presenting a hazard to persons on the ground. Also, the recovery system provides an area for competition when rocketeers hold contests to see whose rocket can remain aloft the longest. In addition,

rocket recovery is an area for valuable experimentation and research as rocketeers develop new and better methods of returning their models to earth or study air currents.

Most recovery systems in use today depend on drag (or wind resistance) to slow the rocket. Each changes the model from a streamlined object to one which the air can "catch against" and retard its descent. Six main recovery methods are used by model rocketeers today. Following is a brief description of each:



1. Featherweight Recovery (i.e. Astron Streak): The model is designed for extra light weight (under 1/4 ounce without engine) and has a blunt nose. When the engine is ejected from the rocket, the model is so light compared to its size that it lands safely. The lightweight, aerodynamically unstable, spent engine casing tumbles back separately.



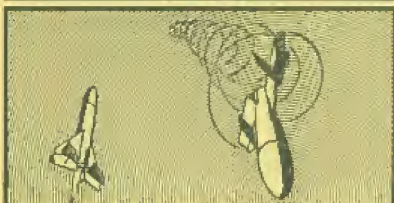
2. Tumble Recovery (i.e. Astron Scout, Sprite): The ejection charge shifts the weight of the engine in the rocket rearward. This makes the rocket unstable. With the balance point of the rocket further toward the rear, air pressures ahead of the balance point are greater than behind, forcing the rocket to start tumbling. When the rocket is tumbling, air drag on it is much higher and it falls slowly. Estes Pat. No. 3,114,317



3. Streamer Recovery (i.e. Astron Mark): A model with a small streamer will act like a tumble model. If the streamer is large enough, it develops enough drag by fluttering to actually hold the rocket back in its descent and it lands gently.



4. Parachute Recovery (i.e. Astron Alpha): The ejection charge forces a parachute connected to the model out of its body tube. The parachute deploys, filling with air, and supports the model on its return.



5. Helicopter Recovery (i.e. Astron Gyro): Vanes on the model, activated by the ejection charge, catch the air in a way that makes them spin on the way down. The spinning vanes disturb the flow of air past the rocket creating a large amount of drag.



6. Glide Recovery (i.e. Astron Falcon, Nighthawk): The model ascends vertically like a conventional rocket. At ejection either the balance of the model or the position of its aerodynamic surfaces is changed. Instead of streamlining straight down, the wings generate lift, pulling the nose up, and the model goes into a glide. Models of this type are called "Boost-gliders". Estes Pat. No. 3,167,960. Other pat. pending.

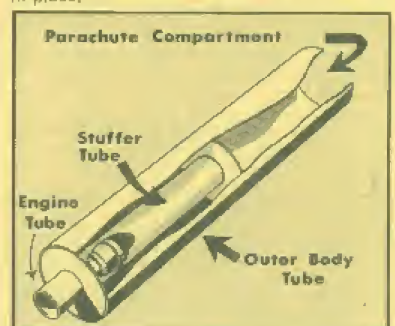
## Reliable Recovery

No rocketeer likes to see the product of many hours' labor broken because the recovery system didn't work properly. Recovery failures are almost always due to an error in building the model or in preparing it for flight.

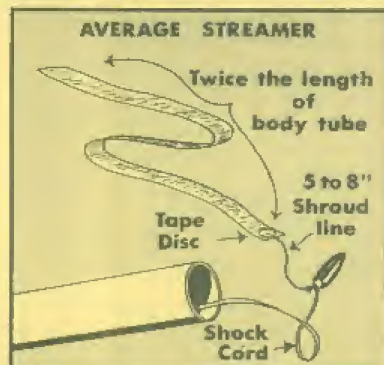
The most common error on parachute and streamer models is failing to install the engine properly. If the engine is not held securely, it will be ejected instead of the streamer or parachute. On models with engine holder hooks, make sure the hook latches properly over the end of the engine. If the model relies on a friction fit to hold the engine, wrap enough masking tape around the engine to make it fit tightly.



A second error is leaving a hole that ejection gasses can leak through. Incorrect engine mount design or construction is often the villain. For reliable recovery the rear of the rocket must be air tight when an engine is in place.



Recovery reliability on extra-large models can be improved by using a stuffer tube. This reduces the volume that the ejection charge must pressurize, resulting in more force to eject the nose cone and chute. A stuffer usually is made from BT-20 or BT-50 body tube, centered inside the model's body, with paper rings glued on each end. The rings should also be glued to the inside of the body so there is no gas leakage into the space between the stuffer and outer body tube.



For high altitude models parachute recovery is often too good; the bird can be miles away by the time it finally touches down. Streamer recovery is often the answer. A strip of 1" wide flameproof crepe paper, usually at least twice as long as the rocket itself, will supply enough drag at the nose to make the rocket fall sideways. In this condition it falls enough faster than with a parachute to bring it back close to the launch area. It falls slow enough, however, to avoid damaging the model.



Whether the model has a parachute or streamer, always be sure to use enough flameproof wadding. The wadding not only serves as an insulating layer between the hot ejection gases and the chute or streamer; it also works as a gas seal and piston to insure that the ejection charge works evenly against the recovery device. Wadding should be loosely packed, filling the entire area of the tube for a distance equal to twice its diameter.

By following these suggestions, you'll find you get many more successful flights. Not only will your models last longer, but you'll also find that reliable recovery makes model rocketry more enjoyable.



# MULTI-STAGING

## Ignition

The first stage of a multi-stage rocket is always ignited by standard electrical means. Second stage ignition occurs automatically upon burnout of the first stage. Figure 1A



shows that the first stage engine has no delay or ejection charge. This gives instant ignition of the next stage at burnout.



In figure 1B the propellant is partially burned, leaving a large combustion chamber. As the propellant continues to burn, the wall of propellant becomes thinner until it cannot withstand the high pressure inside the chamber. At this point the remaining propellant wall ruptures, and the high pressure exhausts forward toward the nozzle of the next stage, carrying hot gases and small pieces of burning propellant into the nozzle of the second stage engine. This action is illustrated in figure 1C.



For this system to work, the stages must be held together until the upper stage engine has ignited. When this happens, the stages must then separate in a straight line. This is accomplished by wrapping one layer of cellophane tape around the joint between engines and then recessing this joint 1/2" rearward in the booster body tube, as in fig. 2. Recessing the joint forces the stages to separate in a straight line.

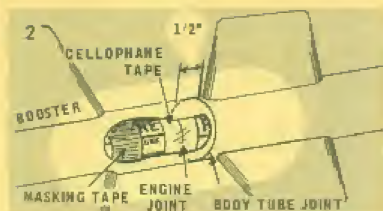
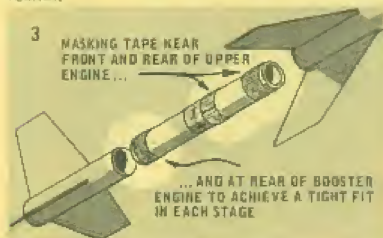
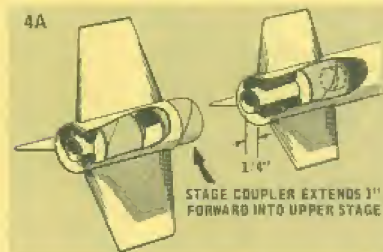


Figure 2 shows the engine installation in a typical two-stage model. Always tape the engines together before inserting them into the rocket. Check carefully before and after taping to be sure the engines are in their proper positions (nozzle of upper stage engine against top end of booster engine). Failure to check carefully can be highly embarrassing as well as damaging to the rocket.

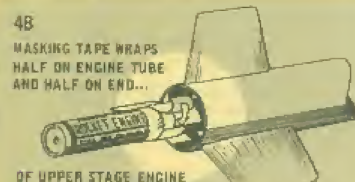


After taping the engines together, wrap masking tape around the upper stage engine at the front and near the rear as in fig. 3 to give it a tight fit in the body. Push it into place. Wrap the booster engine and push it into position. Failure to get the upper stage engine in place tightly enough will result in the recovery system malfunctioning; failure to secure the booster stage tightly can result in its dropping off under acceleration.

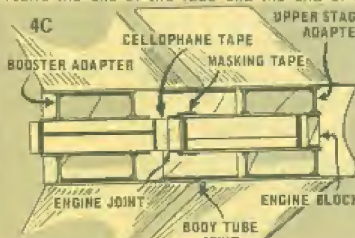


Rockets using large diameter tubes (BT-50 and BT-50Q) require somewhat different methods, but the same principles of tight coupling and straight line separation must be followed. The recommended coupling

method for large diameter tubes is illustrated in fig. 4. The stage coupler is glued to the booster body tube, with the adapter for the upper stage engine mount positioned forward to allow the stage coupler to fit into the upper stage, while the tube adapter in the booster is positioned to the rear.



The upper stage engine holder tube projects 1/4" rearward from the end of the upper body tube. The engine is held in place by wrapping a layer of masking tape tightly around the end of the tube and the end of the



engine as in fig. 4B. The engine mount in the booster must be built to leave space for this system (see fig. 4C).

## Stability

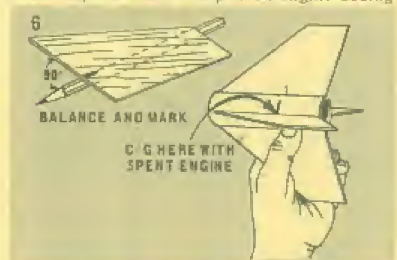
Since two or more engines are mounted near the rear of a multi-stage rocket, it has a tendency to be tail-heavy. To compensate for this, extra large fins are used on lower stage. Generally, the lower set of fins on a two-stage rocket should have two to three times the area of the upper set. Each additional stage requires even greater fin area.



When checking for stability, test first the upper stage alone, then add the next lower stage and test, and so on. In this way you can be sure that the rocket will be stable in each step of its flight, and you can locate any stage which does not have sufficient fin area. Always check for stability with the largest engines to be used in place.

## Booster Recovery

Most lower stages are designed to be unstable after separation. The booster should be built so that the center of the area of the fin (its balance point) matches or is up to 1/4" ahead of the booster's balance point with an expended engine casing



in place. Thus, boosters will require no parachute or streamer, but will normally tumble, flutter or glide back to the ground. If the booster is to be used again, it should be painted an especially bright color, as it does not have a parachute or streamer to aid in spotting it once it is on the ground.

## Types of Engines

Lower and intermediate stages always use engines which have no delay and tracking charge, and no parachute ejection charge. There is no delay so that the next stage will receive the maximum velocity from its booster. The engines which are suitable are those which have designations ending in zero, such as the A8-0, B6-0, 1/2A6-0S, and B14-0.

In the upper stage an engine with a delay and tracking charge and parachute ejection charge is used. As a general rule the longest possible delay should be used. Engines suitable for upper stage use are those with long delays such as the B5-6, A8-5, C6-7, etc.

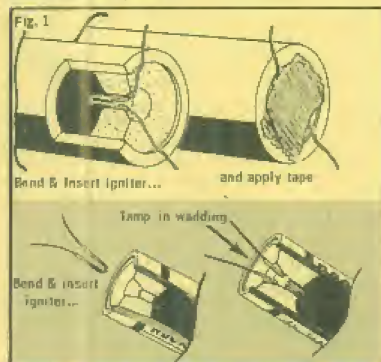


# LAUNCHING

Model rockets, like professional rockets, are launched electrically. This provides both safety and realism. Each engine sold by Estes Industries is supplied with an igniter and complete instructions; still more information is supplied with launcher kits. However, the basic information needed to launch models successfully is included in these pages.

## Igniter Installation

Estes igniters are supplied in strips of three. Cut the igniters apart (scissors will work) midway between the coated sections. Bend the igniter at the middle as shown and push it into the engine as far as it will go. To operate properly the igniter must touch the propellant grain. Spread the leads and apply a square of masking tape to the nozzle and leads as shown in Fig. 1. The eraser on the end of a pencil is good for pressing the tape securely into place.



An igniter can also be held in place by rolling a 1" square of flameproof wadding into a ball and inserting it into the nozzle with a pen or pencil to hold the igniter firmly in place.

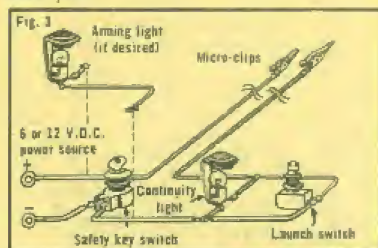
## Electrical Systems

The electrical system which operates the igniter can be made in many ways. It can be a simple home-made unit, as the one shown in Fig. 2, or it can be one of the more complete systems sold by Estes Industries.

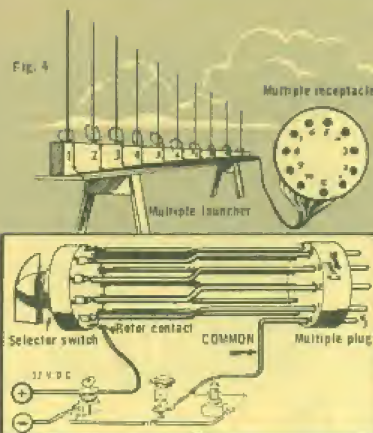


All of these systems work by passing enough electrical current through the high-resistance igniter to heat it to 1100°F. This ignites the coating on the igniter which in turn ignites the engine. The system is attached to the igniter with micro-clips as shown. When connecting the micro-clips to the igniter make sure the clips do not touch each other or the rod or blast deflector. If they do touch, the current from the battery will "short" through the clips, rod or deflector and not reach the igniter.

Any electrical system must have a spring-return launch switch so the current turns off automatically when the button is released. In addition a safety disconnect must be provided. On simple systems the battery clips should be disconnected when the micro-clips are being attached to the igniter. More complete systems may have safety key switches or safety plugs to do the same job.



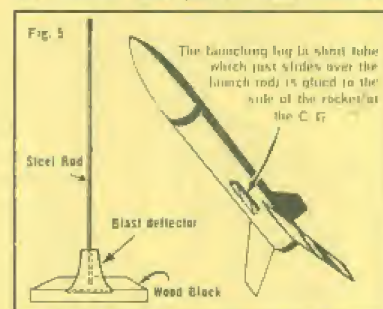
The circuit shown in Fig. 3 also includes a continuity check pilot light. This is a small bulb (no more than ¼ ampere for safety) which lights when the safety interlock is closed if the clips make good connections at both the battery and the igniter. When lit, it indicates that the rocket can be launched.



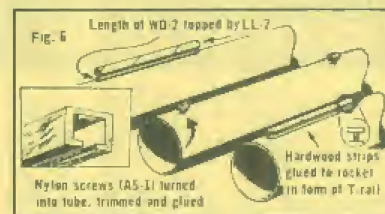
Most rocket clubs prefer a multiple launcher system for group launchings. The basic electrical circuit can be adapted by adding a rotary "paid selector" switch as shown in Fig. 4. Each launch pad then has one micro-clip which is connected to the "common" line to the battery and one micro-clip which is connected to one of the individual terminals on the selector switch.

## Launcher Design

A rocket cannot be simply set on its fins and launched; some method of holding it in position before ignition and guiding it during the first few feet of its flight is necessary. The launcher must perform these functions.



The simplest suitable launcher design uses a wood block to support a 36" long, 1 8" diameter steel rod. A short tube, slightly larger than the rod, is glued to the side of the rocket near its balance point. This tube slips easily over the rod and keeps the rocket pointed in the right direction. Fig. 5 shows a rod launching system.



Some launching guides are designed to fit around the lug instead of inside it. The "C" rail is typical of these. Rails generally have the advantage of being stronger and more rigid than rods. However, most model rockets will fly very well with either system. Fig. 6 illustrates a rail and some lugs to fit.

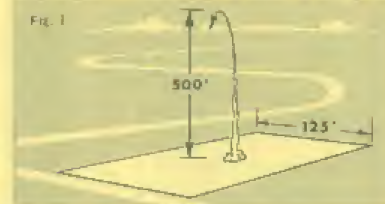
When building a launcher be sure to use a base that is big enough and heavy enough to provide a secure foundation. A piece of 3/4" plywood a foot square works well for most rockets. Bricks or rocks can be used to weight the base when extra-large models are being launched.

## Safety

Make sure the area around the launcher is clear and has no dry weeds or highly flammable materials. When approaching the launcher to mount a rocket or check it, put your hand on the end of the rod before leaning over. This helps protect you against the possibility of eye injury from the rod.

## Launch Areas

The best place to fly models is on a model rocket range. Many such ranges have been set up by organized groups of rocket enthusiasts. However, if such a range is



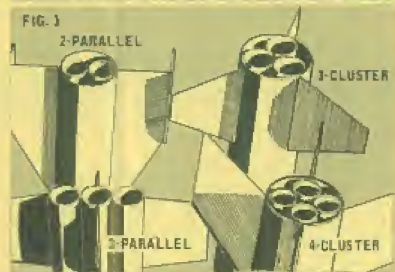
not available, it is best to select a place, free of trees and houses, large enough to recover the rocket within the area. Generally the smallest side of the field should be at least one fourth the maximum altitude your rocket will reach. Set the launcher at the center of the area as shown in Fig. 7.



# CLUSTERING

When large models and heavy payloads have to be launched, one engine often cannot supply enough power. A cluster of several engines is generally the answer to this problem.

## ENGINE ARRANGEMENTS



In designing a clustered model the first rule to remember is that thrust must be balanced around the centerline of the rocket. Figure 1 shows several engine arrangements that satisfy this requirement. All engines should be located close together to keep unbalanced thrust from forcing the model off course.

## ENGINE MOUNTING

The engine mounting system serves three purposes: First, it holds the engines securely in place throughout the flight. Second, it aligns the engines so they work together as a unit and give a straight flight. Finally, it must seal the rear of the rocket so that recovery system ejection gases cannot leak out through cracks and holes in the back of the model.

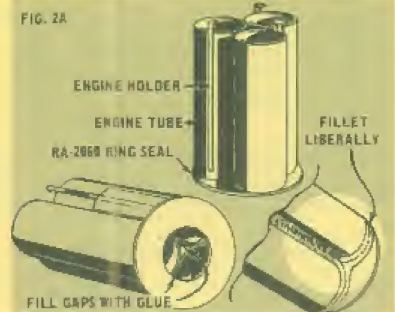
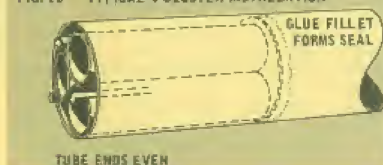


Figure 2 shows a typical engine mounting system for a three-engine model. The spaces between tubes are sealed at the front of the engine mounting tubes by gluing an adapter ring which fits the inside of the body in place as shown. To install the engine mount, smear a liberal amount of glue around the inside of the rear of the body tube. Immediately slide the engine mount unit into place so the rear of the engine mount tubes is even with the rear of the body and the engine retainer hooks project from the tube. Do not pause while inserting the engine mount or the glue may stick with the mount in the wrong place. Set the unit on its rear end while the glue dries.

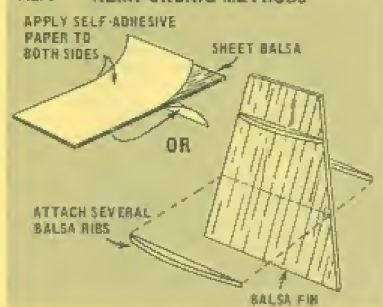
FIG. 2B TYPICAL 3-CLUSTER INSTALLATION



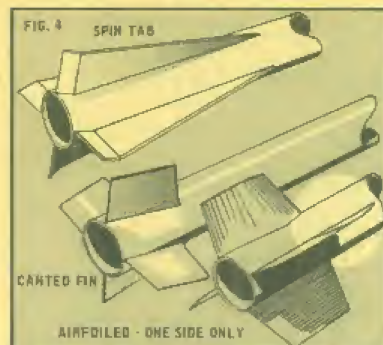
## STABILITY

Because the weight of several engines is concentrated in the rear of a cluster rocket, extra attention should be given to designing the rocket so it is stable. Since the engines will not always all be producing exactly the same amount of thrust at the same time, an extra margin of stability is needed. Pay extra attention to the rules in the stability chapter.

FIG. 1 REINFORCING METHODS



The extra load on a cluster model's fins requires that they be made extra strong. One-eighth inch thick balsa sheet is the most popular fin material for cluster birds. Thinner fin stock can be used, but it should be reinforced for best results.

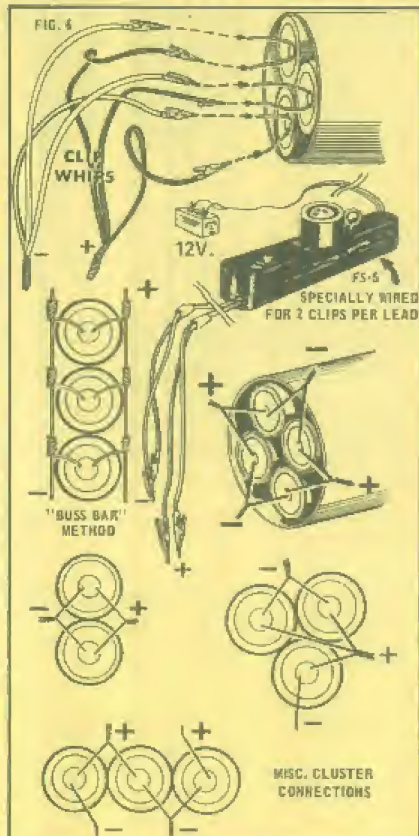
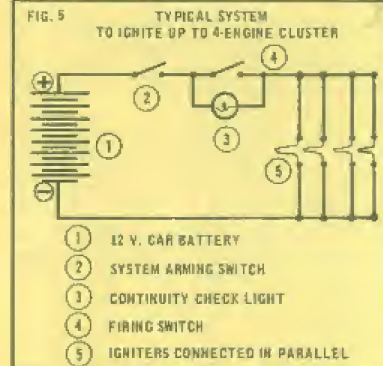


A small amount of spin helps give straighter flights by averaging out uneven thrust. (Too much spin increases drag and reduces performance.) Three methods of providing spin are illustrated. With any system, make sure that all fins or tabs are made to spin the rocket in the same direction.

## IGNITION

Ignition is the most important part of successful clustering. All engines must be ignited at the same time. To do this, always use a 12 volt car battery for the power supply and a heavy duty electrical system (such as the Estes FS-5 Launch Control System). Install the igniters carefully and connect them in parallel.

Several typical methods of connecting igniters are shown in figures 5 and 6. Make connections carefully to get good contact and to avoid pulling the igniters from the engines. Always connect igniters in parallel—never in series.



## GENERAL INFORMATION

Use a heavy-duty launcher such as the Tilt-a-Pad with cluster models. When heavy rockets are being flown, the launcher should be anchored to the ground with rocks or bricks.

Before installing the engines in your cluster rocket, pack the front of each engine above the ejection end cap with flame-proof wadding. This eliminates the possibility of one engine's ejection charge igniting the ejection charge of another engine and damaging the rocket when one engine in a cluster fails to ignite at lift-off. For more complete information on clustering, see Estes Technical Report #TR-6.



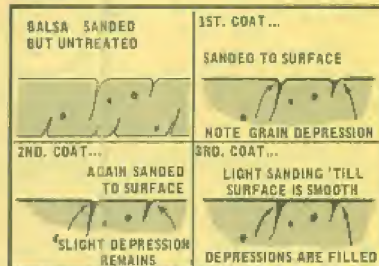
# FINISHING



The finish of a rocket starts with the very first steps of assembly. Sloppy gluing and other messy habits will ruin the appearance of a rocket so that nothing can be done to get the perfect appearance which is desired. On the other hand, careful construction will make a model look good even before the paint is applied.

## SANDING and SEALING

Paint cannot replace sandpaper. If a balsa surface is not sanded and sealed carefully, it will be impossible to get a smooth paint job. Begin by sanding all balsa surfaces with extra-fine sandpaper until smooth.

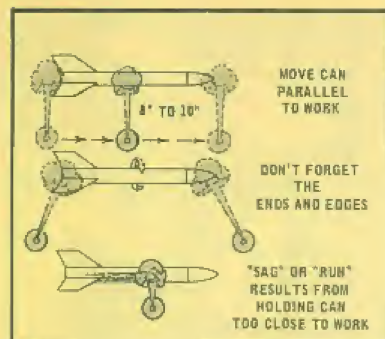


Next, apply a coat of sanding sealer to the balsa. Let this dry completely, then sand with 320 grit (or finer) sandpaper until the surface is smooth again. Apply more sealer, repeating the procedure until all the pores in the balsa are filled.

Practically all of the sealer should be sanded off after each coat. This is because the purpose of the sander is to fill the holes, not the smooth areas of the balsa.

## BASE COLOR

Once you feel the balsa surfaces are prepared, it's time to apply the base color. The base color is the lightest of the colors to be used on the model. Usually this will be white. If the model is to be painted with fluorescent colors, the base coat must be white.

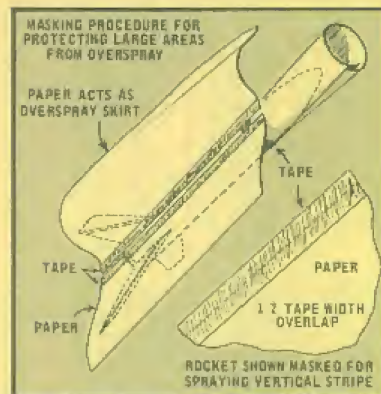
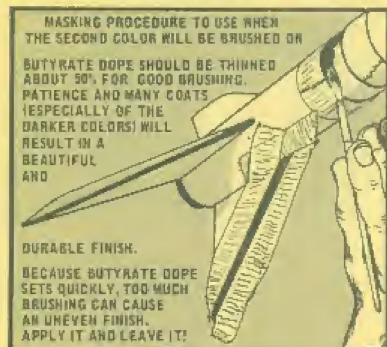


Apply a light, even coat of the base color and set the model aside to dry. Always spray or brush thin coats; thick ones dry slow and tend to "sag". When the first coat has dried completely, sand lightly with extremely fine sandpaper. Wipe any dust off with a clean, slightly damp cloth and apply another coat. Let this dry, then follow with additional light coats until the model has a clear, pure color.

Let the base coat dry completely. Allow at least four hours in a warm, dust-free area (a day is better when possible). Don't let the temperature get over 120° while the model is drying.

## THE SECOND COLOR

When the base color has dried, cover all areas on the model which are to remain this color. Cover small areas with masking tape. Large areas should be covered with typing paper, held down at the edges with masking tape. It's important to seal the tape down tightly along the edge.



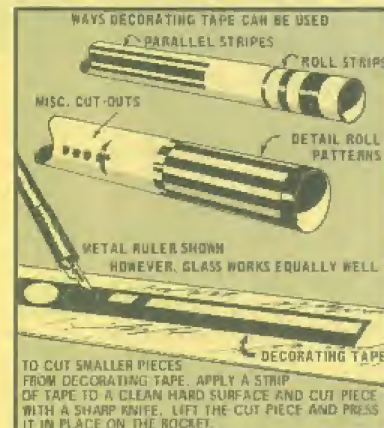
With the model masked, apply an additional thin coat of the first color to finish sealing the edges of the tape. When this is dry, apply the second color in several thin coats. Use just enough paint to get good color. After the last coat is dry, remove the masking carefully to avoid peeling the paint. A third color would be applied in the same way as the second.

## FINAL TOUCHES

For best results let the paint dry overnight before applying decals. Most decals should be soaked in lukewarm water for



30 seconds or until they slide on their backing sheets. The decal is then slid so one edge is off the backing. This edge is positioned and held in place on the rocket and the backing pulled out from under. Smooth the decal down with a damp finger and blot away any excess water with a rag.

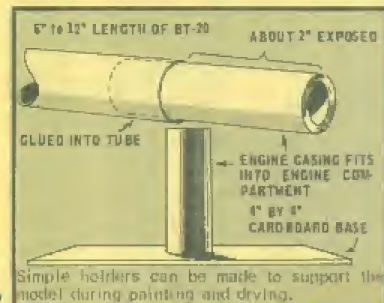


Stripes and bands may be made of either decal material or decorating tape. The pieces should be cut to size before application.

When a model has been finished with fluorescent paint, apply a light coat of clear spray before applying tape or decals. With any paint finish, it is best to apply several coats of clear after the decals have dried to protect them.

Wax may be applied over most enamel or butyrate finishes, but never directly over fluorescent paints. Test the finish to be waxed by applying the wax to an inconspicuous corner of the model or a scrap of tubing with the same paint finish. Some paints will rub off when wax is applied.

**NOTE:** Enamel paint may be applied over butyrate dope, but NEVER APPLY BUTYRATE DOPE OVER ENAMEL PAINT. If in doubt, test the compatibility of different paints on a piece of scrap material.

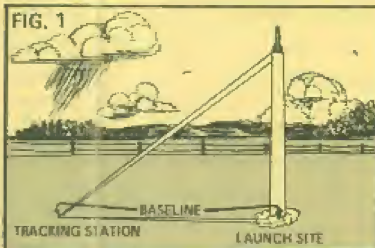




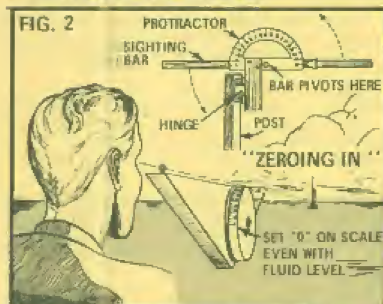
# TRACKING

Every rocketeer wants to know how high his models fly. Many methods of determining a model's peak altitude have been tried, but only one method has proven itself. This method is known as triangulation.

The simplest form of triangulation uses only one very simple tracking device. With it, the rocketeer measures the angle between the ground and the line of sight to the rocket at its peak altitude. When this angle and the distance from tracker to launcher are known, it is very easy to determine the altitude.



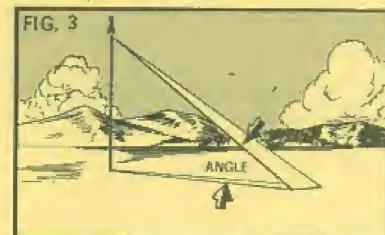
## TRACKERS



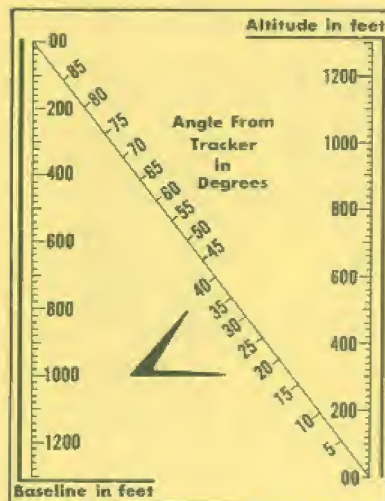
The Estes Altiscope is one of the best all-around basic tracking devices. However, the rocketeer can also easily make his own tracker. An inexpensive plastic protractor, mounted securely on a post set in the ground, with a sighting stick pivoted at the "center" of the protractor, will do the job. The track-

ing device must be set so that it reads 0° when aimed at the rocket on the launcher and 90° when aimed straight up. If the tracker is not "zeroed in" on the launcher, it will give incorrect information.

When the operator at the tracking station is ready, the rocket is launched. He follows the rocket with his tracker as it rises. When it reaches its peak altitude he stops or locks the tracker. The indicated angle is then read from the protractor scale.



The tangent of this angle is found by checking the table on the next page. Multiply the tangent by the distance from tracker to launcher (baseline distance) to find the altitude.

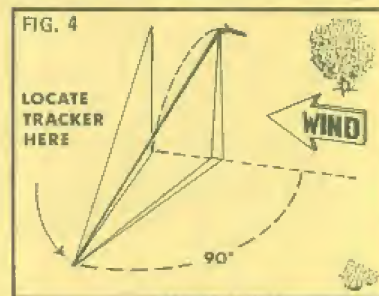


The chart above, called a nomogram, provides a simpler, quicker but less precise

TABLE OF TANGENTS

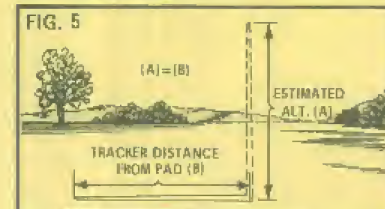
Angle	Tan.	Angle	Tan.	Angle	Tan.
1°	.02	28°	.53	54°	1.38
2	.03	29	.55	55	1.43
3	.05	30	.58	56	1.48
4	.07	31	.60	57	1.54
5	.09	32	.62	58	1.60
6	.11	33	.65	59	1.66
7	.12	34	.67	60	1.73
8	.14	35	.70	61	1.80
9	.16	36	.73	62	1.88
10	.18	37	.75	63	1.96
11	.19	38	.78	64	2.05
12	.21	39	.81	65	2.14
13	.23	40	.84	66	2.25
14	.25	41	.87	67	2.36
15	.27	42	.90	68	2.48
16	.29	43	.93	69	2.61
17	.31	44	.97	70	2.75
18	.32	45	1.00	71	2.90
19	.34	46	1.04	72	3.08
20	.36	47	1.07	73	3.27
21	.38	48	1.11	74	3.49
22	.40	49	1.15	75	3.73
23	.42	50	1.19	76	4.01
24	.45	51	1.23	77	4.33
25	.47	52	1.28	78	4.70
26	.49	53	1.33	79	5.14
27	.51			80	5.67

method for performing the altitude calculation. Draw a straight line from the correct baseline point on the chart, through the measured angle and on across the altitude scale. The correct altitude is the point at which the line crosses the altitude scale.

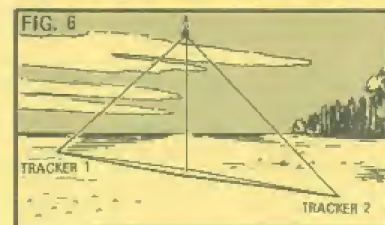


A single tracker will give best results on calm days. Wind interferes with accuracy

since models tend to tilt over into the wind as they fly. The result is that the rocket will not be straight over the launch site at peak altitude, but instead will be some distance over in the direction of the wind. To keep error due to wind drift to a minimum, locate the tracker at a 90° angle to the wind direction as shown.



In determining where to locate a tracking station, estimate the altitude your model will reach. The tracking station should be approximately this distance from the launcher (usually 500 to 1000 feet). Measure the distance from launcher to tracker carefully to insure accurate altitude calculations.



For more precision, use two trackers on opposite sides of the launcher. The easiest way of calculating rocket height using two trackers is to find the altitude for each tracking station and then take the average of these two altitude figures.

More elaborate tracking systems and more elaborate mathematics can be used to gain greater accuracy when the rocket doesn't fly straight up. However, a simple tracking system will do the job very well when good models are flown on calm days. More complete information on basic altitude tracking is contained in Estes Industries Technical Report TR-3.



# BOOST-GLIDE

Boost-gliders are models which fly straight up like any other rocket. However, they glide back to earth instead of coming down suspended from a parachute.

There are four main types of boost-gliders: Conventional front engine, conventional rear engine, pop-pod and parasite. Although these types appear very different, many of the same principles apply to all.



A boost-glider, as any other rocket, must be stable to fly upward. For this reason, most boost-gliders are designed with their engine mounted as far forward as possible. During glide a model must still be stable, but not by nearly so great a margin. If most or all of the engine is positioned ahead of the model's balance point, it will help make the model fly correctly.

## Rear-Engine Models

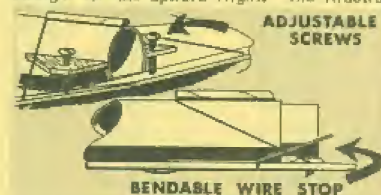
Based on conventional model rockets, the rear-engine boost-glider was the first type developed. Two fins are made extra-large to form wings. Control surfaces, called elevons, are mounted on these wings. The elevons are held straight by the engine during powered flight and coasting. At ejection the engine is expelled from the



rear of the rocket, and the elevons swing up as shown. This forces the rear of the model down slightly so the wing meets the air at an angle, providing lift to support the model.

Many rear engine models are made with extra empty engine casings mounted to the front of the engine to provide extra weight up forward for better stability. With all rear engine models it is important to remember

that all control surfaces must be perfectly straight for the upward flight. The illustration



tion above shows the control systems of a typical model. Estes Industries Technical Report TR-4 contains more information on rear engine boost-gliders.

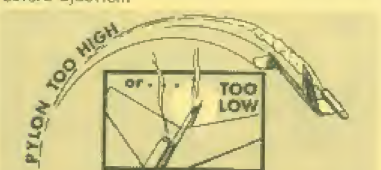
The big problem with rear-engine designs is getting the balance point far enough forward for a good upward flight and still having it far enough rearward for a good glide. The front-engine model solves this by putting the weight of the engine at the extreme front on the way up.

## Front-Engine Principles

The engine in a front engine model should be positioned so that its rear is at least as far forward as the middle of the root of the wing. Looking at the model from the side, the centerline of the engine, the bottom surface of the wing,



and the horizontal stabilizer must all be perfectly parallel. If any of these is at an angle, the model will tend to travel in one big loop and will probably be on the ground before ejection.



The pylon that supports the engine holder should be about 1/2 inch high, if it is too high, off-center thrust will force the

nose of the rocket down. If it is too low, the tail will either be scorched or struck by the ejecting engine. For more information on front-engine models, see Estes Technical Report TR-7.

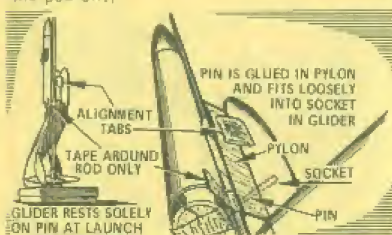
## Pop-Pods

For the highest performance from a glider, its weight and drag must be kept to a minimum. The Pop-Pod helps by removing both the weight and drag of the engine



mount. The particular system shown, introduced by Estes Industries, has been adopted by almost every boost-glider designer.

The Estes Pop-Pod (also known as strip pod) can best be explained as a finless parachute or streamer model rocket with a forward-slanting pin on which a glider is hooked. The glider, which fits loosely on the pin, serves to stabilize the whole assembly on the way up. At ejection, the reaction of the nose cone ejecting slows the pod while the inertia of the glider carries it forward and off the hook. (If the pin is a *little* tight, the drag of the parachute will usually pull the pod off.)



For this system the pod must be supported on the launch rod with the glider hanging from it. The pod must be loose enough so it will fall off if the glider is held with its nose up. As with conventional front-engine models, the engine, wing and stabilizer must be parallel.

## Parasite Gliders

The first parasite glider systems were built with two gliders fitting on opposite sides of a finless, parachute-recovered core. Since then, a wide variety of models has been built on this principle.



For best results, a parasite model should be built with a long, very stable core vehicle. The glider should be mounted close to the center of gravity of the core. One loose pin at the front of the glider is enough to hold it in place on the way up.

## Glide Testing

A boost-glider must be "trimmed" to glide correctly before launching. Most rear engine models are trimmed by adjusting the elevons until a straight flat glide is achieved. Other models are trimmed by adding or removing weight at the nose.

When trimming a model, give it a straight, smooth, level toss into the wind and note how it performs. If it stalls, add weight to the nose. If it dives, remove weight from the nose. If it turns too much, place a *very small* weight on the wing which is on the outside as it turns.



Few models are as spectacular in flight and as enjoyable to watch as a good boost-glider. The rocketeer looking for a challenge will find that developing improved boost-glide designs is one of the most rewarding areas of research in model rocketry.



# SAFETY

## THE DANGEROUS PAST

Most of today's model rocketeers were not concerned with rockets during the "dangerous years" of youth rocketry. These years, from



Dean Richer of 327 E. Dartmouth Ave. tries to conduct his son, Lynn, 15, as the youth receives emergency treatment at Denver General Hospital after a homemade rocket exploded and blew off part of his right hand Wednesday. "Just tell the other kids to be more careful when they're working with explosives," the nurse student asked.

—Rocky Mountain News Photo by Henry M. Rhoads.

1957 to 1965, were the years between the time Russia launched the first earth satellite, Sputnik, and the time model rocketry became well known.

In those "early days" when a newspaper article told about a young rocket experimenter, it was usually a tragic story... like the boy in California who loaded a metal pipe with match heads which exploded, killing him instantly and crippling his friend for life... or the teacher who was killed, and seven of his students injured, when he filled an improvised rocket with explosive chemicals. Still another case was of a young man losing an eye using zinc dust and sulphur in a CO<sub>2</sub> cartridge.

These unfortunate incidents happened to thousands of America's young rocketeers. Why? Because the space age had started and practically every science-oriented young man wanted to build a rocket. However, no safe way was readily available for him to do so. The situation was so bad that the Institute of Aeronautics and Astronautics estimated that a "basement bomber" experimenter had a 1 in 7 chance of being seriously injured or killed for each year he participated. A careful

## A "ROCKET" THAT KILLS



The most frequent killer in "basement bomber" tragedies has been a combination of match heads and metallic CO<sub>2</sub> cartridges. Match heads, when confined, are a powerful, sensitive and highly dangerous explosive—wholly unsuitable for rocket experiments.

analysis pointed to the following contributing factors as the major reasons for these rocketeer accidents:

1. A strong desire to build and launch a rocket.
2. A plentiful supply of low cost, (readily available) dangerous materials for use in rocket experiments.
3. A lack of knowledge of the dangers involved.
4. The unavailability of safe materials for the experimenter.

## The Solution..

The Estes approach to safety for American rocketeers has taken three directions. First—we've tried to make every potential rocket builder aware of the disastrous results of "basement bomber" type activities by telling him of the dangers of home-compounded fuels and metal rockets. Secondly—we've marketed a line of rocket products which can be flown with a high degree of safety. Then, to make it

a complete program, we've provided, along with these carefully engineered products, a wealth of safety oriented literature and technical information. Thus, the rocketeer is guided through his "rocket career" with little chance of serious injury.

Over the past few years, we've received a number of letters from young men saying, "Thank you for saving my life." It's the kind of letter which makes us very proud because it may indeed be the case—and we've met the prime objective of our program.

**POSITIVE SAFETY VALUE:** These are the words often used to describe the overall safety effect of model rocketry. By using the word POSITIVE we are making reference to a PLUS or ADDITIVE situation. We are, in effect, saying that America's rocketeers will have fewer accidents resulting in personal injury or property loss because model rocketry exists and is widely and freely available.

From YOUTH ROCKET SAFETY REPORT  
by Vern Estes -- March, 1967

## A Word on Making Rocket Engines...

At the Estes plant rocket engines are made automatically, under controlled conditions, with limited amounts of propellant being measured by explosion proof metering devices. We've spent many thousands of dollars in engine development work and plant layouts. Only highly-trained personnel are permitted near this operation. We still consider it a dangerous job, but a necessary one if we're to provide you with a safe form of rocketry.

If you would like to someday make rocket engines, we'd recommend you first get a college degree. Then you'll need some expensive special equipment, a safe place to work, and some specialized training.

If you attempt to build rocket engines with less than the above, you may find as some chemistry teachers, students and many others have, that through the rest of your life you will be without a finger, hand, arm, eye, ear, face, or you may be badly burned or even killed. Our country needs live rocket scientists and engineers who have all their fingers and hands. We are looking forward to fellows like you who have a special interest in rocketry to fulfill this need.

Dear Sirs  
RECEIVED JUNE 11 1966  
Recently I was seriously considering building my own rocket with my own home-made fuel system. Tonight I received your paper with the report of injuries on such projects. I didn't know about these dangers and now I have decided to leave my model rocketry to the manufacturers and not take on any of these home-made projects. I thought I would write this little note just to thank you for making me more safety-minded. No matter how large or small.  
ANSWERED: I have you very much  
Sincerely,  
Bob L. Brown



# ROCKET ENGINE DESIGN

Today's model rocketeer can choose from an amazing variety of engines to power his models. He has an engine available for almost every purpose.

The engines the rocketeer uses come in two main types: end-burning and center-burning. End-burning engines are by far the most popular with model rocketeers. They have a big advantage because they can be built to give a dual level thrust action as shown by the B6-4 thrust curve.

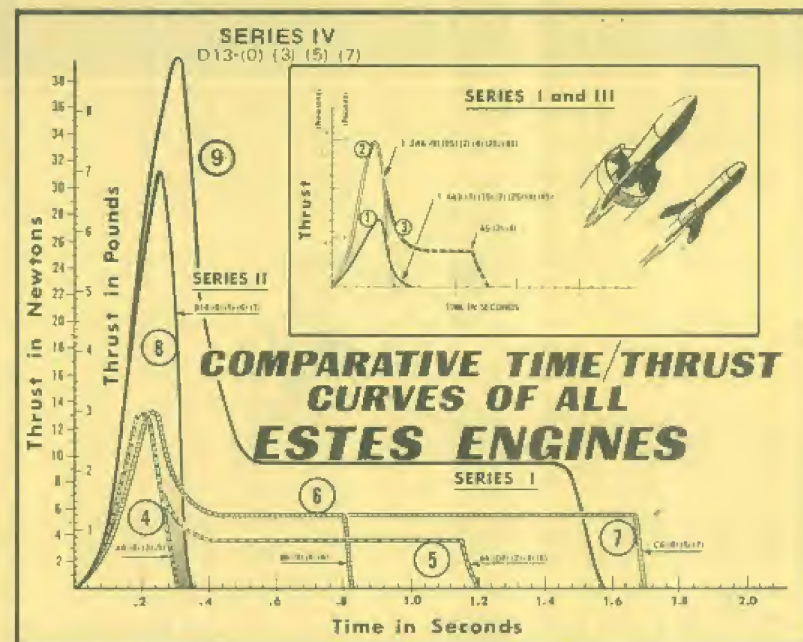
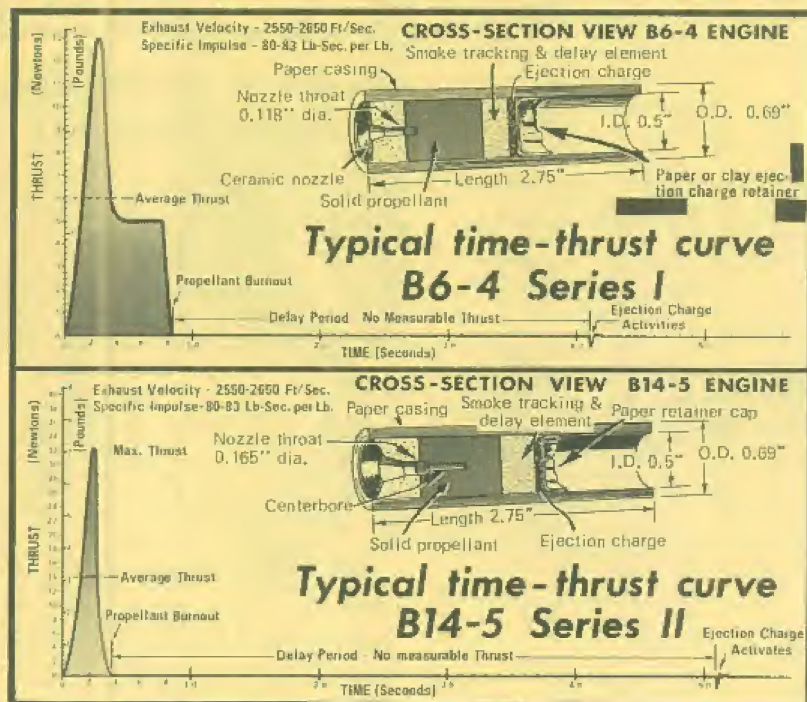
This design is especially effective with light-weight high performance rockets. The high initial thrust boosts the rocket to a suitable flying speed almost immediately; thrust then drops to a lower sustaining level to maintain speed and gain the most distance with the least fuel consumption.

For heavy rockets especially those carrying large payloads, a second type of

engine is available. The center-burning engine produces a very high average thrust, but only for a short period of time. This is more efficient for the heavy rocket since it brings the rocket to an adequate flying speed with less fuel than would be used by low thrust engines. The B14-5 thrust curve is typical of center-burning engines.

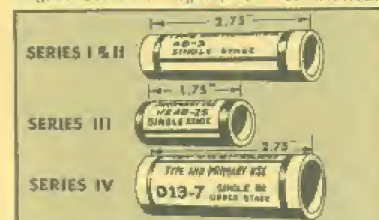
Single and upper stage model rocket engines of both types operate the same after the propellant has been burned. The end of the propellant ignites a slow-burning smoke tracking/delay element. This "delay charge" produces no thrust, but lets the model coast upward, leaving a smoke trail behind.

After several seconds the delay charge ignites an ejection charge which pressurizes the forward end of the rocket body to force the parachute out of the tube. (This gas pressure can be used instead to operate many types of recovery system other than para-



chutes.) If the correct engine is selected, ejection should occur at about the time the rocket has reached its peak altitude.

End-burning engines come in three sizes. The most common, known as Series I, is 2.75 inches long and 0.69 inches in diameter. A smaller type, the Series III engine, is 1.75 inches long, and the same diameter. It is simply a shorter version of certain lower power Series I engines. A large engine, Series IV, providing twice the power of the largest Series I engine, is also available.



Center-burning engines are classified as Series II. For more complete information, see the performance graphs and cut-away drawings.

## THRUST CURVES

By studying the chart above you can learn much about the expected performance of your model using any type of engine.

For instance, looking at Curve 8 and noting the extremely high thrust of the B14 engine, you'd know your rocket would accelerate quickly to a high velocity. Then, of course, at propellant burn out, it would also slow down quickly due to the high drag of a rocket traveling so fast. The question you'd ask yourself then is...Would my rocket go higher using one of the other B engines which provides less acceleration but keeps pushing for a longer period of time?

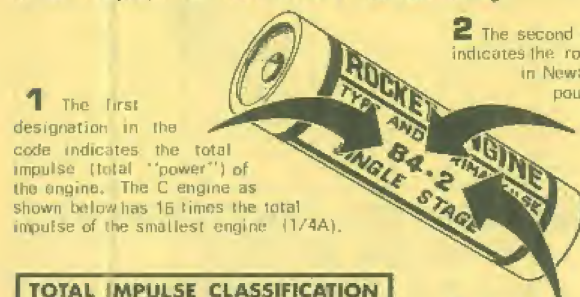
## NOTICE

This rocket engine design and performance information is given for educational purposes only. We believe that if you understand how your rocket engine works you are in a better position to gain scientific knowledge from your activities and to design your rockets for specific purposes such as payload experimentation, altitude studies, drag racing, etc. We DO NOT grant permission for you to attempt to copy our design nor do we recommend that you attempt to build your own rocket engines.



# ENGINE CLASSIFICATION

All engines sold by Estes Industries are stamped with a code designation which, when understood, will give the rocketeer important and useful data on the engine's performance capabilities. Here's how to read this coding:



**1** The first designation in the code indicates the total impulse (total "power") of the engine. The C engine as shown below has 16 times the total impulse of the smallest engine (1/4A).

**2** The second designation, a whole number, indicates the rocket engine's average thrust in Newtons. (1 Newton equals 0.225 pounds). For normal and most high performance flying an average thrust of 3 to 8 Newtons is best. For high lift off weights and high acceleration studies, the Series II engine with an average thrust of 14 Newtons is recommended.

**3** The last number following the dash gives the delay time in seconds from thrust burn out to activation of the recovery system (parachute) ejection charge. Engines with an "O" in this position have no delay or ejection charge and are used only in the bottom stage(s) of multi-stage rockets. Series III engines have an "S" following this designation indicating the engine is shorter.

TOTAL IMPULSE CLASSIFICATION		
Code	Pound-Seconds	Newton-Seconds
1/4A	0.14	0.625
1/2A	0.28	1.25
A	0.56	2.50
B	1.12	5.00
C	2.24	10.00
D	4.48	20.00

## OTHER ENGINE INFORMATION

### ENGINEERING:

Today the Estes engine represents the end result of over 11 years' efforts in engineering, craftsmanship and quality control. The total impulse of the Estes engine is closely controlled which allows us to make our engines very near the maximum permissible size in a given class. In addition, the average thrust, peak thrust and delay times are set to give the best overall performance for sport flying and competitive events.

### QUALITY CONTROL:

Three out of every hundred engines made by Estes Industries are static tested on a recording type of test stand which graphically records the maximum thrust, thrust variations, minimum thrust, overall thrust duration, length of time delay, and the strength of the ejection charge. Any batch of engines which does not meet rigid standards is discarded. In addition, the engine production machines

automatically reject all engines which do not contain the correct amount of propellant. All tolerances are kept as small as possible so that these engines make excellent propulsion units for contests, exhibitions and science studies.

### SAFETY:

Rocket engines are not toys, but scientific devices. With common sense and close adherence to safety rules, model rocketry is as safe as any other sport, hobby or scientific study. Carelessness can make it dangerous, as with model airplanes, baseball or swimming. If you are hit by a model rocket traveling 300 or more miles per hour, you will be hurt. Use common sense and follow the safety code. Don't spoil model rocketry's excellent record of safety.

### LABEL COLOR:

The label color indicates the recommended use. Green for single stage, purple (or blue) for top stage of multi-stage rockets and red for booster or intermediate stages.

# MODEL ROCKET PERFORMANCE

The kits, components and engines produced by Estes Industries have been designed to cover the entire performance range from low altitude sport and demonstration models to high altitude, high performance payload and competition rockets. By choosing his kits, materials and engines carefully, the rocketeer can fill his performance needs exactly. Complete specifications are given on all items to make this selection easy.

**HOW HIGH WILL YOUR MODEL GO?** The chart below shows the approximate altitudes that can be achieved with single stage rockets.

Engine Size	Altitude Range (depending on rocket size and weight)	Approximate Altitude in a typical 1 oz. model
1/4A3-2	50' to 250'	100'
1/2A6-2	100' to 400'	190'
A8-3	200' to 650'	450'
B6-4	300' to 1000'	750'
C6-5	350' to 1500'	1000'
D13-5	400' to 2000'	1600'

(Some high performance models will reach higher altitudes than shown above.)

(When flown at 0.3 oz. model.)

### ENGINE SIZE:

There are several things that affect the performance of a model. The first of these is engine size. The greater the total impulse of an engine, the higher it will boost a model.

### WEIGHT:

In most cases, the heavier a rocket, the less altitude it will reach. A baseball can be tossed higher than an 8 pound cannon ball; the same holds true for model rockets. In addition heavier rockets are more apt to tilt at an angle as they leave the launcher, reducing altitude even more.

Weights listed for rocket kits in the catalog do not include engines. To determine the lift-off weight of a model, add the engine weight, shown in the engine selection chart, to the kit weight.

### WIND RESISTANCE:

Drag, or wind resistance, is the third item which affects performance. The more drag on a rocket, the less altitude it will reach. A number of factors determine the amount of drag on a rocket. The more frontal area the rocket has, the greater its drag will be. As a result, large diameter model rockets will generally not reach as great an altitude as smaller diameter rockets with the same engine power. Rough surfaces create turbulence in the air as it flows past the rocket, increasing drag. Smooth finishes will increase the capability of the model. The stability of the rocket also affects drag—if it wobbles in flight, it will have greater drag. Careful attention to reducing drag can sometimes double a rocket's altitude capability.



# MEASUREMENTS

## METRIC and ENGLISH

Although model rocketry started in the United States, there are today many thousands of active rocketeers in other countries around the world. Because the metric system is standard in almost every nation in which model rocketeers are active, engine specifications based on the metric system have replaced the former English system specifications.

Since rocketeers in this country use both systems of measure, some information will appear using one system, other items will use the other system. The conversion table below makes it easy to change English measurements to metric and vice versa.

### CONVERSION TABLE English to Metric Measure

MULTIPLY-----BY-----TO OBTAIN	MULTIPLY-----BY-----TO OBTAIN
centimeters 0.3937 inches	meters 39.37 inches
feet 0.3048 meters	meters 3.281 feet
feet 0.3048 meters per second	meters 3.281 feet per second
grams 0.0353 ounces	newtons 0.225 pounds (force)
kilograms 35.3 ounces	newton-seconds 0.225 pound-seconds
kilograms 2.207 pounds	ounces 28.35 grams
inches 25.4 millimeters	pounds (force) 4.45 newtons
millimeters 0.0394 inches	pound-seconds 4.45 newton-seconds



**4.45 Newtons = 1 Pound of Force**

Energy is required to make an object move. This energy which causes motion is applied as a **FORCE**. Scientists express forces in units of measurement call **NEWTONS**. A newton is the amount of force needed to move a mass of one kilogram with an acceleration (change in velocity) of one meter per second each second. In other words, a force of one newton will make a mass of one kilogram change speed by one meter per second during every second the force is acting.

**ACCELERATION (in meters per second per second) = FORCE IN NEWTONS ÷ MASS IN KILOGRAMS**

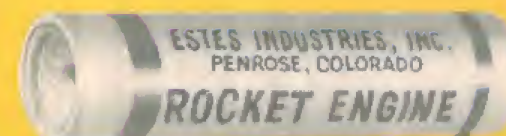
#### EXAMPLE:

A Saturn model rocket of 0.36 kilograms (12.54 oz.) mass, acted upon by a force of 24 newtons (5.400 lb.), will be accelerated at the rate of 66.6 meters (218 ft.) per second per second.



A SUBSIDIARY OF DAMON

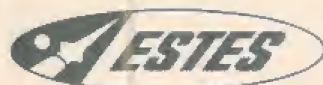
## SAFE RELIABLE ENGINES



Without the development by Estes Industries of safe, easy-to-use model rocket engines, model rocketry might never have become the safe, fascinating hobby that it is today.





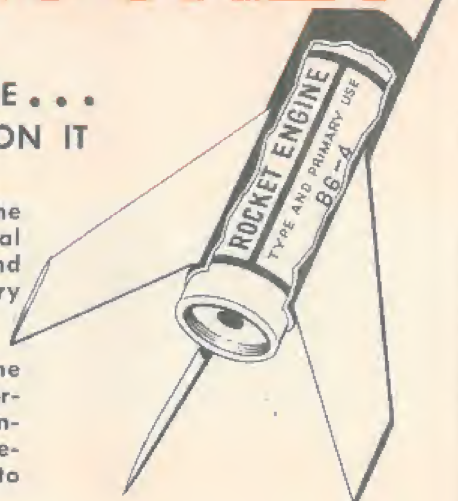


# ROCKET

THE FINEST ENGINE MADE . . .  
. . . YOU CAN DEPEND ON IT

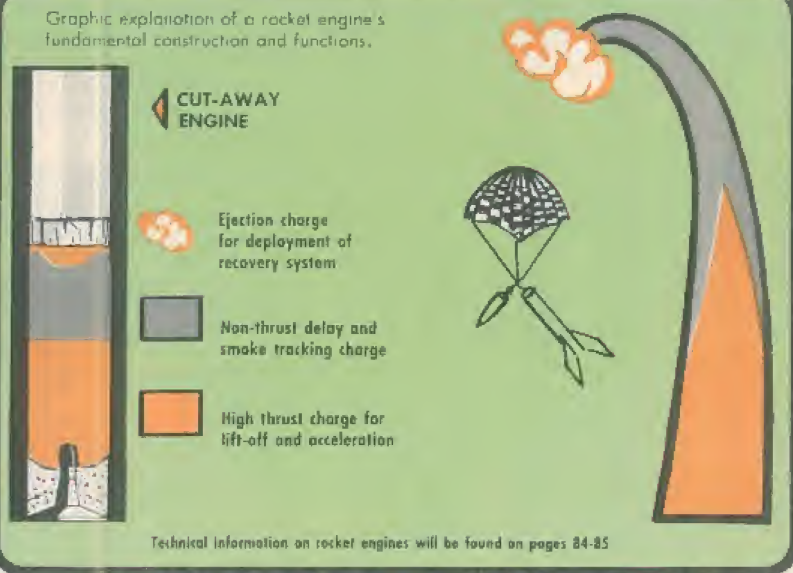
The design and development of the Estes model rocket engine was the real beginning of the safe, educational and exciting program that model rocketry has become.

Today's modern rocket engine is the result of over 11 years of engineering efforts at Estes Industries. Consequently, today's rocketeer has dependable, safety-proven engines to carry on his rocket activities.



Designed for specific launch and flight functions, rocket engines are expendable — not re-usable.

Graphic explanation of a rocket engine's fundamental construction and functions.



Technical information on rocket engines will be found on pages 84-85

# ENGINES

QUALITY  
TESTED ENGINES  
FOR HIGH PERFORMANCE FLIGHTS

. . . for every flight application

The energy-packed, solid propellant Estes model rocket engine is a complete power system for your rocket. It is designed and pre-manufactured to perform all power functions for dependable launch and activation of a recovery system. In one compact package it provides thrust for quick lift-off and acceleration to high altitudes, allows for a timed delay period to reach peak altitude while delivering smoke trail for easy tracking, and supplies ejection power for the parachute or other system for your rocket's safe return to earth.

Reliability-proven in over 20 million launchings, Estes engines are manufactured under controlled conditions within exacting tolerance limits. You can count on them for consistent performance from one launch to the next. You'll launch with confidence in contest and exhibition flying.

Six power levels are available in Estes engines. Total impulse is tailored to fit the various NAR-FAL classes. Average thrust, peak thrust and delay times are set up to give the best performance within these classes and to provide the most useful selection of engines for all rocketeers.

Engine prices and basic data are listed on pages 92-95.

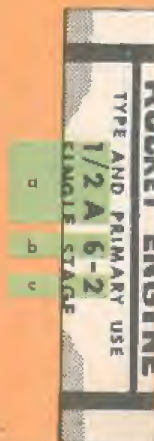
## ENGINE CODING FOR QUICK-N-EASY IDENTIFICATION

### 1. Label color indicates recommended use of the engine.

- a. GREEN . . . . . Single stage rockets
- b. PURPLE & BLUE . . . Top stage of multi-stage rockets
- c. RED . . . . . Booster and intermediate stages of multi-stage models

### 2. Code designation stamped on the engine gives useful and important information on its performance capabilities.

- a. This portion indicates total impulse or total power produced by the engine.
- b. This portion shows the engine's average thrust in newtons and helps you choose the right engine for your rocket's flight
- c. This number gives you the delay in seconds between burnout and ejection charge. Lets you choose the engine with the delay time you want for any flight.



Igniters and complete instructions are included with Estes engines.





# ROCKET ENGINE

## Prices and Specifications

Cat. No. and Engine Type	Prices		Total Impulse		Time Delay (± 15%)	Maximum Lift-off Weights With Engines
	Each	3 for	lb sec <sup>(1)</sup>	n-sec <sup>(2)</sup>		
SINGLE STAGE ENGINES						
1/4A3-1	\$ .35	\$ .70	0.14	0.625	1 sec	1.5 oz.
1/4A3-2	\$ .35	\$ .70	0.14	0.625	2 sec	1.0 oz.
1/2A6-2	\$ .40	\$ .80	0.28	1.25	2 sec	2.5 oz.
A5-2	\$ .45	\$ .90	0.56	2.50	2 sec	3.0 oz.
A8-3	\$ .45	\$ .90	0.56	2.50	3 sec	4.0 oz.
B4-2	\$ .50	\$ 1.00	1.12	5.00	2 sec	4.0 oz.
B4-4	\$ .50	\$ 1.00	1.12	5.00	4 sec	3.5 oz.
B6-4	\$ .50	\$ 1.00	1.12	5.00	4 sec	4.5 oz.
B14-5*	\$ .55	\$ 1.10	1.12	5.00	5 sec	5.0 oz.
C6-3	\$ .60	\$ 1.20	2.25	10.00	3 sec	4.0 oz.
C6-5	\$ .60	\$ 1.20	2.25	10.00	5 sec	4.0 oz.
UPPER STAGE ENGINES <sup>(3)</sup>						
1/4A3-4	\$ .35	\$ .70	0.14	0.625	4 sec	.75 oz.
1/2A6-4	\$ .40	\$ .80	0.28	1.25	4 sec	1.0 oz.
A5-4	\$ .45	\$ .90	0.56	2.50	4 sec	1.5 oz.
A8-5	\$ .45	\$ .90	0.56	2.50	5 sec	2.0 oz.
B4-6	\$ .50	\$ 1.00	1.12	5.00	6 sec	1.5 oz.
B6-6	\$ .50	\$ 1.00	1.12	5.00	6 sec	2.0 oz.
B14-6*	\$ .55	\$ 1.10	1.12	5.00	6 sec	3.5 oz.
B14-7*	\$ .55	\$ 1.10	1.12	5.00	7 sec	2.5 oz.
C6-7	\$ .60	\$ 1.20	2.25	10.00	7 sec	2.5 oz.
BOOSTER ENGINES						
1/2A6-0	\$ .40	\$ .80	0.28	1.25	none	4.0 oz.
A8-0	\$ .45	\$ .90	0.56	2.50	none	4.0 oz.
B6-0	\$ .50	\$ 1.00	1.12	5.00	none	4.0 oz.
B14-0*	\$ .55	\$ 1.10	1.12	5.00	none	6.0 oz.
C6-0	\$ .60	\$ 1.20	2.25	10.00	none	4.0 oz.
STATIC TEST ENGINES <sup>(4)</sup>						
B4-0(P)	\$ .50	\$ 1.00	1.12	5.00	none	Don't Fly It!

# SELECTION CHART

## Data for correct engine choice

Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Replaces Old Engine Type
		Oz.	Gr.	Oz.	Gr.	
GREEN LABEL						
22 oz.	0.24 sec	0.48	13.6	0.027	0.78	1/4A.8-2
22 oz.	0.24 sec	0.50	14.2	0.027	0.78	.....
46 oz.	0.20 sec	0.53	15.0	0.055	1.56	1/2A.8-2
46 oz.	0.50 sec	0.59	16.7	0.110	3.12	.....
48 oz.	0.32 sec	0.57	16.2	0.110	3.12	A.8-3
48 oz.	1.20 sec	0.70	19.8	0.294	8.33	B.8-2
48 oz.	1.20 sec	0.74	21.0	0.294	8.33	B.8-4
48 oz.	0.83 sec	0.78	22.1	0.220	6.24	B.8-4
7 lb.	0.35 sec	0.69	19.6	0.220	6.24	B3-5
48 oz.	1.70 sec	0.88	24.9	0.440	12.48	.....
48 oz.	1.70 sec	0.91	25.8	0.440	12.48	.....
PURPLE or BLUE LABEL						
22 oz.	0.24 sec	0.51	14.5	0.027	0.78	1/4A.8-4
46 oz.	0.20 sec	0.54	15.3	0.055	1.56	1/2A.8-4
46 oz.	0.50 sec	0.64	18.1	0.110	3.12	A.8-4
48 oz.	0.32 sec	0.62	17.6	0.110	3.12	.....
48 oz.	1.20 sec	0.78	22.1	0.294	8.33	B.8-6
48 oz.	0.83 sec	0.71	20.1	0.220	6.24	B.8-6
7 lb.	0.35 sec	0.71	20.1	0.220	6.24	B3-6
7 lb.	0.35 sec	0.73	20.7	0.220	6.24	B3-7
48 oz.	1.70 sec	0.95	26.9	0.440	12.48	.....
RED LABEL						
46 oz.	0.18 sec	0.48	13.6	0.055	1.56	1/2A.8-0 <sup>B</sup>
48 oz.	0.30 sec	0.51	14.2	0.110	3.12	A.8-0
48 oz.	0.80 sec	0.58	16.4	0.220	6.24	B.8-0
7 lb.	0.35 sec	0.61	17.3	0.220	6.24	B3-0
48 oz.	1.68 sec	0.80	22.7	0.440	12.48	C.8-0
BLACK LABEL						
48 oz.	1.20 sec	0.69	19.6	0.294	8.33	B.8-0(P)

Notes:

Complete instructions and igniter (NWI-1) are included with each rocket engine ordered from Estes Industries.

All Series I and II engines are 2.75 in. long and 0.690 in. dia.

① Pound seconds

② Newton seconds (figures shown are maximum)

③ Closest previous equivalent is shown

④ OR single stage engines if used in very tight rockets

⑤ Replaces both 1/4A.8 and 1/2A.8 booster engines

⑥ Static test engine with plug to prevent blow through.

See Page 102 For Igniters

Comparative time thrust curves on all Estes engines are shown on pages 84 & 85.

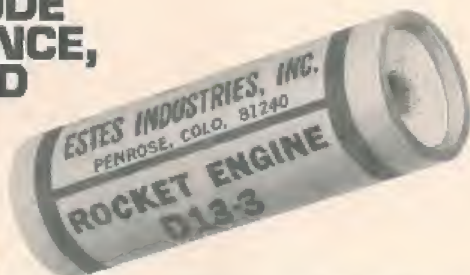
Shipping wt. of each engine is approximately 1-1/3 oz.



# MIGHTY

Cat. No. and Engine Type	Prices		Total Impulse		Time Delay (± 15%)	Maximum Lift-off Weights With Engines
	Each	3 for	lb sec <sup>①</sup>	n-sec <sup>②</sup>		
D13-0	\$ .75	\$2.00	4.48	20.00	none	13.0 oz.
D13-3	\$ .75	\$2.00	4.48	20.00	3 sec	13.0 oz.
D13-5	\$ .75	\$2.00	4.48	20.00	5 sec	10.0 oz.
D13-7	\$ .75	\$2.00	4.48	20.00	7 sec	8.0 oz.

## ESTES 'D' POWER FOR HIGH ALTITUDE PERFORMANCE, BIG PAYLOAD LAUNCHES



RECOMMENDED ONLY FOR EXPERIENCED ROCKETEERS

# SHORT

Cat. No. and Engine Type	Prices		Total Impulse		Time Delay ( ± 15%)	Maximum Lift-off Weights With Engines
	Each	3 for	lb sec <sup>①</sup>	n-sec <sup>②</sup>		
SINGLE STAGE ENGINES						
1/4 A3-1S	\$ .35	\$ .70	0.14	0.625	1 sec	1.5 oz.
1/4 A3-2S	\$ .35	\$ .70	0.14	0.625	2 sec	1.0 oz.
1/2 A6-2S	\$ .40	\$ .80	0.28	1.25	2 sec	2.5 oz.
A5-2S	\$ .45	\$ .90	0.56	2.50	2 sec	3.0 oz.
UPPER STAGE ENGINES <sup>③</sup>						
1/4 A3-4S	\$ .35	\$ .70	0.14	0.625	4 sec	.75 oz.
1/2 A6-4S	\$ .40	\$ .80	0.28	1.25	4 sec	1.0 oz.
A5-4S	\$ .45	\$ .90	0.56	2.50	4 sec	1.5 oz.
BOOSTER ENGINES						
1/2 A6-OS	\$ .40	\$ .80	0.28	1.25	none	4.0 oz.
A5-OS	\$ .45	\$ .90	0.56	2.50	none	3.0 oz.

# 'D' ENGINES

Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Recommended Use	Notes:
		Oz.	Gr.	Oz.	Gr.		
9 lb.	1.48 sec	1.44	40.9	0.879	24.93	Booster Engine	Complete instructions and igniter (NWI-1) are included with each rocket engine ordered from Estes Industries.
9 lb.	1.50 sec	1.49	42.2	0.879	24.93	Single Stage	
9 lb.	1.50 sec	1.52	43.1	0.879	24.93	Single Stage	
9 lb.	1.50 sec	1.55	44.0	0.879	24.93	Single or Upper	

With the advancement of model rocketry to bigger birds, larger payloads and higher altitude demands, Estes Industries has developed the 'D' engine (Series IV).

The Estes big 'D' provides twice the power of the largest Series I engine. It's the first dependable 'D' engine to provide the consistent high-thrust and total impulse levels necessary for peak performance in its class.

Precision manufacturing capability, experience and quality control at Estes Industries assure superior and consistent performance for Estes 'D' power—the same quality and reliability which have been proven in over 20 million Estes-powered launches.

When flying your rockets with the more powerful 'D' engines give even greater consideration to normal safety precautions. Refer to items 5, 6, 7, 13 and 14 in the safety code on page 145.

Helpful notes on page 96 covering design of rockets for Estes 'D' power are important to study when you are ready to build your big 'D' birds. Previous rocketry experience is essential before going to 'D' power rockets.

Shipping wt. of each engine is approximately 2-1/3 oz.

All Series IV engines are 2.75 in. long and 0.945 in. dia.

① Pound seconds

② Newton seconds (figures shown are maximum)

③ Closest previous equivalent is shown

④ OR single stage engines if used in very light rockets

Comparative time thrust curves on all Estes engines are shown on pages 84 & 85.

Series III engines are 1.75 in. long and 0.690 in. dia.

## Series I & II engines listed on pages 92-93.

Maximum Thrust	Thrust Duration	Initial Weight		Propellant Weight		Replaces Old Engine Type <sup>③</sup>
		Oz.	Gr.	Oz.	Gr.	
GREEN LABEL						
22 oz.	0.24 sec	0.36	10.2	0.027	0.78	1/4 A.8-2S
22 oz.	0.24 sec	0.38	10.8	0.027	0.78	
46 oz.	0.20 sec	0.41	11.6	0.055	1.56	1/2 A.8-2S
46 oz.	0.50 sec	0.47	13.3	0.110	3.12	
PURPLE or BLUE LABEL						
22 oz.	0.24 sec	0.39	11.1	0.027	0.78	1/4 A.8-4S
46 oz.	0.20 sec	0.42	11.9	0.055	1.56	1/2 A.8-4S
46 oz.	0.50 sec	0.52	14.7	0.110	3.12	
RED LABEL						
46 oz.	0.18 sec	0.36	10.2	0.055	1.56	1/2 A.8-OS
46 oz.	0.48 sec	0.42	11.9	0.110	3.12	



# DESIGN NOTES

## BUILDING "D" POWERED MODELS

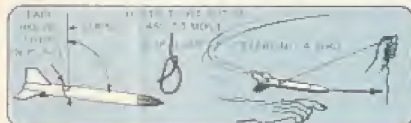
Estes "D" engines open a whole new world of performance to the model rocketeer. Its greater total impulse and higher initial thrust make it easy to fly larger, more advanced designs.

Although most conventional model rocket building and flying techniques can be used, there are a few important differences to remember when building models for "D" power. Special attention is important in three areas — stability, engine mounting and multi-staging.

### STABILITY

A "D" engine weighs about twice as much as a conventional Series I or II engine. This results in a reduced concentration of weight in a rocket that must be allowed for in designing the model to make sure it will be stable.

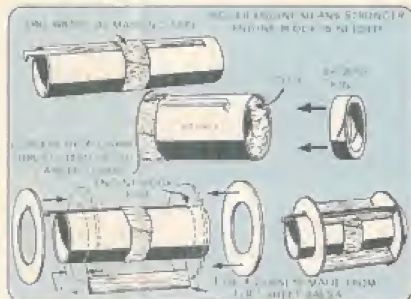
Don't just stick a "D" engine mount in a standard model and expect it to fly. Always string test your model before flying it over the technical section of your Estes catalog. If necessary, add nose cone weights or enlarge the fins until it does pass the string test.



Fins on a "D" bird should be made extra strong to withstand the higher acceleration and speed the model will encounter. One-eighth inch thick balsa sheet is generally the best fin stock to use.

### ENGINE MOUNTING

A Series IV "D" engine will mount inside a BT-20 body tube much the same as a standard engine fits a BT-20. However, the engine mount in a "D" bird must be made extra strong. For best results use an EH-2 engine holder to retain the engine and use an AR-2050 ring as an engine block.



If this assembly is to turn over into a larger body tube, the adapter system must be extra strong. For a BT-55 size rocket the AR-2055 rings should be used. In larger tube rockets the rings should be reinforced with gussets as shown. Always use plenty of glue and let it dry completely.

## MULTI-STAGING

The greatest difficulty in multi-staging with "D" engines comes in keeping the fins on booster stages. The problem arises when booster and upper stages separate — the booster starts to tumble at high speed, causing extremely high forces on the fins. The result is that the fins will break off at staging unless they are attached very strongly.

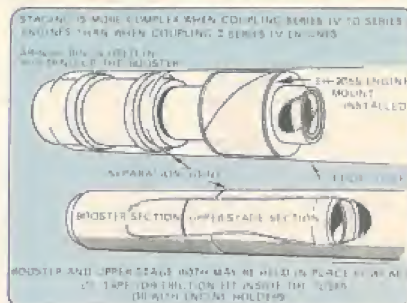
Booster fin material must be strong. One-eighth inch thick balsa is best. Don't make the fins excessively large. Generally, booster fins on D birds shouldn't need to be more than 1-1/2 times the size of upper stage fins. Attach the fins securely. One method of reinforcing the



fin root is shown, the inventive rocketeer should be able to come up with other, equally good methods.

It isn't necessary to tape "D" engines together when multi-staging. However, the rocket must be built so that the stages slide apart in a straight line when they separate. The engines must be positioned so the nozzle of the upper stage engine is directly in line with the top of the booster engine.

If a Series I, II, or III upper stage engine is used it should be positioned so its nozzle and touches the top end of the booster engine. Again, it is not necessary to tape the engines together, but it is necessary to make sure that the stages will slide apart in a straight line.

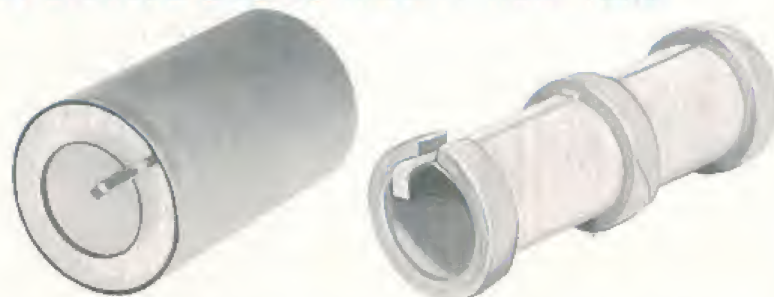


Regardless of the size of the upper stage engine, the stage coupling should be designed so the stages slide apart in a straight line for at least 3-4" before they separate. This helps the upper stage continue a straight flight and makes ignition more reliable.

Whether you "D" bird is a single or multi-stage model, fly it on a calm day when there's good visibility so you don't lose it. Always follow the safety code you'll find it makes rocketry more enjoyable, too.

# 'D' ENGINE ADAPTERS

## LAUNCHING VERSATILITY WITH QUICK CHANGE ENGINE MOUNT ADAPTERS



Fly your Saturn V with a single "D" engine or with its regular cluster power. Complete adapter kit is interchangeable with Saturn's present engine mounting system. Holds "D" engine securely in place. (Adapter now included free with all K-36 Saturn V kits.) Weighs only 0.4 oz. (11.3 gr.). Shipping weight 5 oz.

Cat. No. 694-EM-5063 ..... \$ .50

Fly your Series IV "D" bird with a Series I or II engine. Here is a quick change engine mounting that lets you convert easily to lower power for special flights. Heavy duty construction with a weight of only 0.19 oz. (5.3 gr.). Shipping weight 5 oz.

Cat. No. 694-EM-2050 ..... \$ .35

## INTERCHANGE "D" ADAPTER OR CLUSTER WITH EASE



Figure 1 shows cluster launching system in position on Saturn V. It is retained securely by an EH-2 engine holder. Figure 2 shows cluster removed, ready for insertion of "D" adapter. Figure 3 shows "D" engine system in position, secured and ready to launch the easy way. Making the change is a matter of less than a minute.



# THE KEY TO SAFE DEPENDABLE LAUNCHES

Estes Launching systems and components are designed for perfect lift-off of your rockets. Advanced features include space age miniaturization, self-powered, launch-anywhere units with push button control, key-controlled safety interlock and continuity check light. The next 8 pages have everything you need to get those birds off the ground.



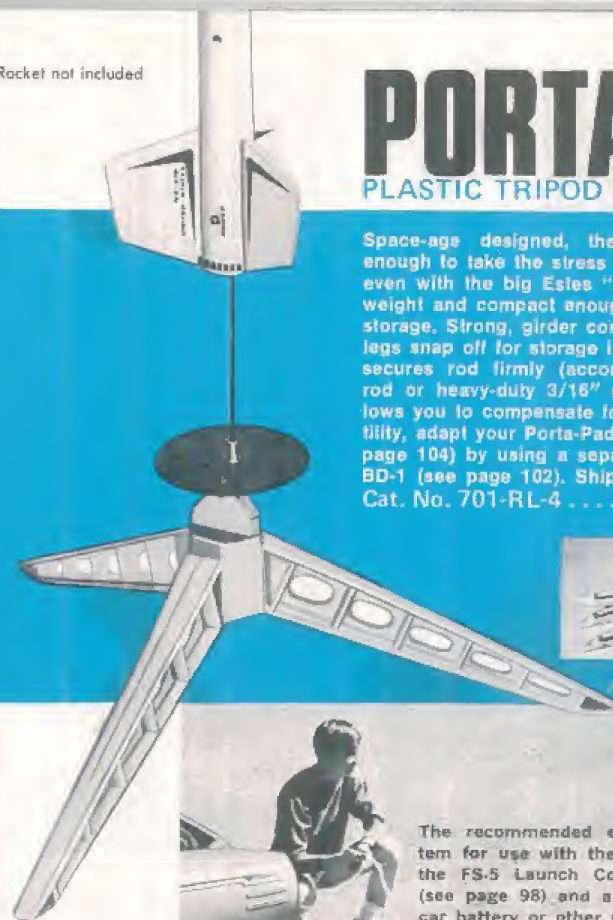
## COMPLETE LAUNCH CONTROL SYSTEM



The perfect system to modernize and add flexibility to your launching program. Use with a 12 volt car battery for any model, including the large birds. Kit includes the above launch controller panel, 18 ft. of No. 18-2 zip cord, micro clips, battery clips, and assembly instructions. Use with either 6 or 12 volt power supplies. Shipping weight 12 oz. **Cat. No. 701-FS-5 . . . . \$3.50**

Use with a 12 volt car battery (no need to remove battery from car; just connect the Launch Control System's battery clips to the battery terminals) for any model, including the large birds. If you don't have access to a car battery, use a Ray-O-Vac No. 918, Eveready No. 731, or a Burgess TW-1, available at most hardware stores.

Rocket not included



## PORTA-PAD PLASTIC TRIPOD LAUNCHER

Space-age designed, the Porta-Pad is rugged enough to take the stress of countless launchings, even with the big Estes "D" engines, yet is lightweight and compact enough for easy carrying and storage. Strong, girder construction, yellow plastic legs snap off for storage in field box. Friction grip secures rod firmly (accommodates standard 1/4" rod or heavy-duty 3/16" rod). Tilt adjustment allows you to compensate for wind. For extra versatility, adapt your Porta-Pad for rail launchings (see page 104) by using a separate blast deflector No. BD-1 (see page 102). Shipping weight 1 lb., 8 oz. **Cat. No. 701-RL-4 . . . . . \$2.50**



The recommended electrical system for use with the Porta-Pad is the FS-5 Launch Control System (see page 98) and a 6 or 12 volt car battery or other power source.

## MULTI-PAD

Ideal launch system for clubs. Sequentially launches one to six model rockets. Plug-in an extra launch rack to increase capacity to twelve rockets. System operates from any 12-volt car battery. Safety key switch for power supply. Panel lights for power supply and for continuity check for each pad selected. Built-in public address system includes push-to-talk microphone and efficient outdoor speaker. Shipping wt. 24 lbs.

**Cat. No. 711-MFS-1 . . . . . \$150.00**

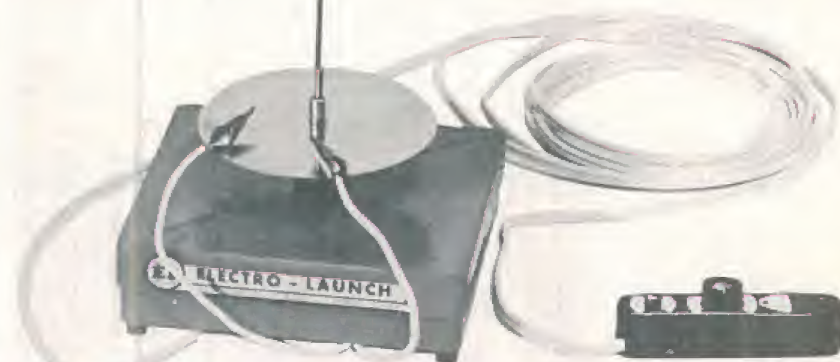




Rocket not included

The biggest little launcher  
in the world!

# ELECTRO LAUNCH



THE completely self-contained launching system for "all in one" ease and mobility. A high impact plastic base and extra large blast deflector assures dependable operation throughout your rocketry career. Features push button ignition control from a hand held unit with a safety interlock and check light to prevent misfiring. Requires 4 size D photoflash cells (not included) for 6 volt operation. Easily converts to 12 volts for extended battery life and heavy duty use by adding 4 extra batteries and changing to a 12 volt pilot bulb. Use it for rockets weighing up to 6 oz., or anchor the base to the ground for heavier models. For launching cluster models, add extra battery pack (page 102) or use LAUNCH CONTROL SYSTEM FS-5 (page 98) with 12 volt car battery. Shipping weight 30 oz.

Cat. No. 701-FS-4 ..... \$4.50

Same kit as above, but batteries for 6 volt operation included. Shipping wt. 46 oz. Cat. No. 701-FS-4B ..... \$5.50

# TILT-A-PAD LAUNCHER \$3.00



Rocket not included

This flexible launcher gives you ideal launch control and convenience. Tripod stand permits launching of rockets up to 12 oz. (and adjusts to fit uneven ground). Tilts to compensate for wind direction and speed. Legs fold down for compact storage. Use with Launch Control System FS-5 (page 98) or any other electrical ignition system. Comes in easy to assemble kit form with complete instructions. Shipping wt. 2 lbs. Cat. No. 701-RL-3 ..... \$3.00

## LAUNCH CONTROL SWITCH



Designed for a perfect countdown and launch sequence. Same as in the ELECTRO-LAUNCH, it features safety interlock, continuity check light and push button controlled launching. Comes in a kit with 12 volt pilot light and instructions for wiring into your system or portable launcher. Shipping weight 6 oz.

Cat. No. 701-FSS-4 ..... \$1.60

## PHANTOM ELECTRO LAUNCH



Ideal for demonstrations and regular launch duty. Clear plastic construction shows the inner workings. 12 volt circuit comes complete with 8 size D photoflash cells for instant ignition flight after flight. Comes with all parts, instructions, and launch systems manual. Shipping weight 62 oz.

Cat. No. 701-FS-8B ..... \$7.50

Without photoflash cells. Shipping weight 30 oz.

Cat. No. 701-FS-8 ..... \$5.00

## EXTRA INTERLOCK KEY

for Electro-Launch and above systems

Cat. No. 651-FSK-4 ..... \$1.10



# LAUNCHING SUPPLIES



**BATTERY PACK:** Durable plastic cased 12 volt battery pack, ideal for use as a booster for the Electro-Launch, a power supply for other launchers, phone systems or any other range power application. Can be set up to deliver 3, 6, 9, or 12 volts, requires 2, 4, 6, or 8 size D cells (not included) depending on voltage desired. Comes in kit form with complete instructions. Shipping weight 1 pound.

Cat. No. 701-BP-2 ..... \$3.00



**TWO PIECE ROD:** Handy collapsible two piece rod for portable launchers. Pieces slip together to make a 36" long rod. Base rod has a diameter of 1/8". Shipping weight 6 oz.

Cat. No. 651-RLR-1 ..... \$ .35



**ADD ON ROD:** Sturdy 1/8" diameter, 18" long launch rod section expands two piece rod (see above) to 53" length, gives extra control of flight path. For a constant 1/8" diameter launch rod, join two or three add-on sections together. Shipping weight 6 oz.

Cat. No. 701-RLR-3 ..... \$ .25 per section



**DELUXE BLAST DEFLECTOR:** Durable pressed steel plate deflects engine blast out and away from launcher. Two inches wide, five inches long. Ideal for launchers that receive extensive use. Shipping weight 5 oz.

Cat. No. 701-BD-1 ..... \$ .50



**BLAST DEFLECTOR PLATE:** Slip-on metal deflector plate fits any launcher using 1/8" rod, protects launcher base from rocket blast. Four inch diameter. Shipping weight 5 oz.

Cat. No. 701-BD-2 ..... \$ .40



**PIVOT:** Adjustable launch rod mounting pivots up to 25° to compensate for tilt of launcher base, windage, etc. Easy-to-assemble, mounts to launcher base with 2 #4 screws. (Rod not included.) Shipping weight 2 oz.

Cat. No. 701-LP-1 ..... \$ .45



**IGNITERS:** Easy-to-use, extra reliable igniters — the same type as supplied with all Estes engines. Suitable for ignition systems using 6 volts or more, see engine instructions for installation procedure. (Patent No. 3,363,559) Shipping weight 1 oz.

Cat. No. 701-NWI-1 ..... 6 for \$ .20



**SWIVEL ASSEMBLY:** Perfect launcher swivel for all launchers. Provides 360° rotation and full tilt adjustments, yet locks securely in selected position. Handle 1/8" rod, 3/16" rod, and C-rail. Shipping wt. 3/4 oz.

Cat. No. 711-LP-2 ..... \$1.50

**NICHROME WIRE:** Electrical heating wire for model rocket ignition. #30 recommended for use with car batteries, #32 for use with other power supplies. Shipping weight 1 oz.

No. 30, 15 FOOT ROLL: Cat. No. 651-NW-30A ..... \$ .50

No. 32, 15 FOOT ROLL: Cat. No. 651-NW-32A ..... \$ .50



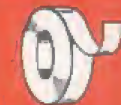
**BATTERIES:** Extra powerful size D photoflash batteries pack the energy needed for rocket launching. These are the type specified for the Electro-Launch, deliver up to 16 amperes of current on a complete short when fresh. Shipping weight 4 oz. each.

Cat. No. 651-PFB-1 ..... \$ .30



**MASKING TAPE:** Use to secure engines in models, mask for painting, etc. Strong, flexible 1/2" wide tape comes in 30' rolls. Shipping weight 5 oz.

Cat. No. 701-MT-1 ..... \$ .40



**MICRO-CLIPS:** Equip your launcher with the best. Spring-loaded solid copper clips attach lead wires to igniters. Easy to clean and highly conductive with flat contact surfaces. Only 1.1 inches long, attach to leads with or without solder. Shipping weight 1 oz.

Cat. No. 651-MC-1 ..... 2 for \$ .25



**GIANT BATTERY CLIPS:** Ideal for hookup to car batteries, heavy duty clips connect to terminals up to 1" in dia. Clips are 3" long, available with black or red insulators. Specify color(s) when ordering. Shipping wt. 5 oz.

Cat. No. 701-BC-1 ..... \$ .45



**BATTERY CONTACTS:** Spring brass battery clips for special battery installations, replacement part for the Electro-Launch. Fit size D cells, can be trimmed to fit smaller batteries. Shipping weight 1 oz.

Cat. No. 651-BC-2 ..... 2 for \$ .20



**LEAD WIRE:** Flexible, durable size 18 two conductor insulated wire. Ideal as a lead from firing panel to launcher, zip the conductors apart for wiring inside the panel. In 12 foot lengths. Shipping weight 5 oz.

Cat. No. 701-LW-12 ..... \$ .75



**TERMINAL LUGS:** Tiny 1/2" long solderless lugs make electrical connections a snap — insert bare wire into the end of the lug and crimp in place with pliers. 1/8" hole for terminal. Shipping weight 1 oz.

Cat. No. 651-TL-1 ..... \$ .05





# RAILS FOR RAIL LAUNCHING

## Rigid aluminum 'C' rails offer countless new possibilities for your launcher designs

The rail is a hollow square shape with its cross section in the form of a squared C. This new concept in lift-off guidance permits greater flexibility in launcher design and construction. With the rail your rocket is guided at lift-off by lugs travelling smoothly inside the length of the hollow opening, making possible many structural adaptations not useable with a rod-type launcher. The rail can be attached to rigid structures for launcher designs or devices for precise angle adjustment. It offers great possibilities for scale or semi-scale models of America's space launch facilities.

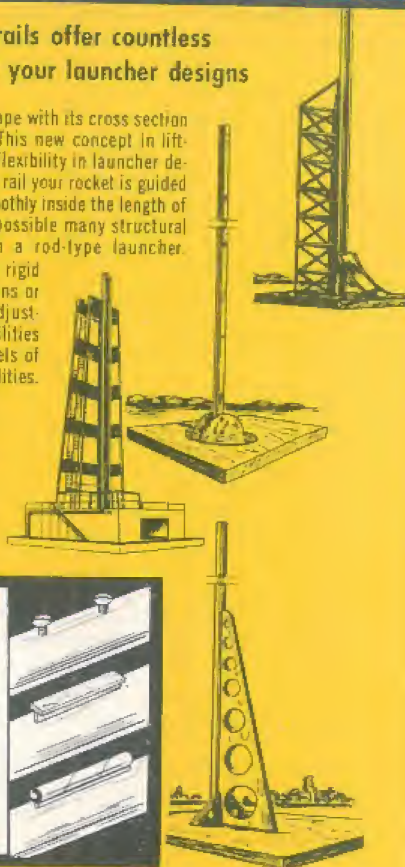
A few design possibilities are illustrated. Many other exciting rail launch designs of the future will come from your own experiments.

Any model rocket can be adapted to rail launching and several proven lug designs are shown in the box below.

Nylon screws (AS-1) turned into body tube, trimmed and glued in place.

Two pieces of thin hardwood cut from tongue depressor or stir stick, glued into "T" rail form, then glued to rocket.

Length of WD-2 topped by a length of LL-2.



**'C' RAIL:** 3/4" square (outside). Comes in 18" long sections. Durable aluminum for long life and rust-free service. Use at least 2 sections connected with a joiner (see below) for launch rail. Shipping weight 6 oz.

Cat. No. 681-LR-18A ..... \$ .50 each section

**RAIL JOINER:** Spring clip 2" long by 1/4" wide, fits inside rail ends, holds two rail sections securely together for assembling launch rails 36" long and longer. Shipping weight 2 oz.

Cat. No. 691-RJ-18A ..... \$ .30 each

## ELECTRICAL EQUIPMENT

**PILOT LIGHT HOLDER:** Add visual control to your launch panel by wiring in an arm or continuity check pilot light. Holder is steel with 1/2" red plastic jewel, mounts in 7/16" hole. Takes either 6 or 12 volt bulbs, bulb not included. Shipping weight 4 oz.

Cat. No. 701-LH-1 ..... \$ .80

**6 VOLT BULB:** Fits holder No. LH-1. Shipping weight 1 oz. (Type 51.)

Cat. No. 651-AL-6 ..... \$ .20

**12 VOLT BULB:** Fits holder No. LH-1. Shipping weight 1 oz. (Type 53.)

Cat. No. 651-AL-12 ..... \$ .20

**KEY SAFETY SWITCH:** A must for every control panel. Prevents accidental launching of rockets. SPST, turns on with key, must be turned off to remove key. Mounts in 1/2" hole. One key included with switch. Shipping weight 4 oz.

Cat. No. 691-KSW-1A ..... \$2.75

**EXTRA KEY:** Cat. No. 651-KSW-1K ..... \$ .25

**PUSH BUTTON SWITCH:** Heavy duty construction momentary type, SPST, normally open. Excellent for use as a firing switch. Mounts in 1/2" hole. Shipping weight 4 oz.

Cat. No. 651-SWM-1 ..... \$ .90

**ROTARY SWITCH:** Twelve position single pole rotary switch — just right for use as a selector switch with firing systems using more than one launcher. With twelve positions, this switch should handle almost any need. Non-shorting, mounts in 3/8" hole. Shipping weight 5 oz.

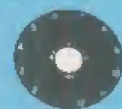
Cat. No. 701-SWR-1 ..... \$1.45

**DIAL PLATE:** Numbered 12 position plate for use with rotary switch No. SWR-1. Mounts on panel with same nut used to hold switch. Etched aluminum on black background. Shipping weight 1 oz.

Cat. No. 701-DP-1 ..... \$ .30

**SOLDERING IRON:** 25 watt, top quality tool for making good connections in launchers and other electrical circuits. Does the work of irons of higher wattage. Develops up to 720° F. Handle remains cool. Replaceable, pre-tinned nickel-plated tip gives extra long life. Use with ROSIN core solder. Shipping wt., one pound.

Cat. No. 671-SI-1 ..... \$4.00





# ALTISCOPE

Determine Rocket Altitudes

Learn Math and Trig



Patent No. 3,208,147

How high did it go? Find out with the Altiscope! Only one instrument is required for determining approximate altitudes (usually within ten percent). Use two together for even greater accuracy. Your altiscope can also be used to find heights of trees, buildings, mountains, poles, etc. Easy to assemble, easy to use, the Altiscope comes in kit form complete with instructions, trig tables, technical report TR-3 on altitude tracking and 2-D altitude computer. Shipping wt. 20 oz.

Cat. No. 701-A-1 ..... \$3.00

**EASY TO USE!**

## Computing Equipment

**2-D COMPUTER:** Build your own easy-to-use altitude computer. Get this set of charts and instructions — everything you need except tape, thumbtacks and glue — assemble the 2-D computer in a few minutes. Designed for use with one or two Altiscopes, easily used with other tracking systems. Shipping weight 2 oz. Kit includes technical report, TR-3

Cat. No. 701-AC-1 ..... \$3.00

**DIAL SCALE:** No more guesswork. Weigh your birds — or any of the parts. Calibrated in both grams and ounces, it is accurate to within 2 grams at full load. Weighs items up to 9 oz. For rockets just slip hook into launch lug, or a pan can be improvised. Shipping wt. 5 oz.

Cat. No. 701-WS-1 ..... \$3.50

**6" POCKET SLIDE RULE:** Ideal companion to the Altiscope. This durable plastic rule is complete and accurate, features A, B, C, CI, D and K scales on front plus S, T, and L scales on back for computing altitudes and working logarithm problems. With vinyl case and instructions. Shipping weight 5 oz.

Cat. No. 701-SR-3 ..... \$1.40

**10" DECIMAL TRIG MULTI-LOG SLIDE RULE:** A big rule at a small price. Complete with 22 scales in a functional grouping for mathematics, science and engineering — covers full log-log and trig requirements. Includes double faced, spring loaded adjustable cursor, operating instructions and protective carrying case. Shipping weight 11 oz. Cat. No. 701-SR-4 \$4.00

See page 115 for book "Learn Basic Slide Rule" (inc. slide rule)

**GRAPH PAPER:** For rocket performance charts, stability graphs and countless other uses. 8½" x 11" sheets with 7½" x 10" grid area, divided into 1/10" squares. Shipping weight 4 oz.

Cat. No. 701-GP-1 ..... 20 sheets for \$ .50

**LOG-LOG GRAPH PAPER:** Perfect for special performance graphs, altitude and velocity charts, etc. Two by two cycle grid on 8½" x 11" paper, can handle greater value ranges than standard graph paper. Shipping wt. 4 oz.

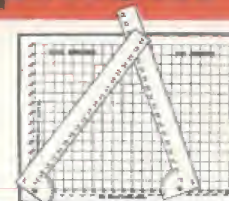
Cat. No. 701-GP-2 ..... 20 sheets for \$ .50

**FLIGHT DATA SHEETS:** New double size (11" x 17"), printed on both sides. One side has spaces in sequence for pre-flight, count-down, launch and flight summary data. Other side is a rocket designers plan sheet with a large ¼" grid space for ease in drawing your plans.

Cat. No. 701-DS-2 ..... 5 for \$ .25

**WIND METER:** Rugged, pocket-size instrument for determining wind velocity. Indispensible to the serious rocketeer for studying wind effects on rocket and parachute performance. Shipping weight 5 oz.

Cat. No. 693-WM-1 ..... \$7.25



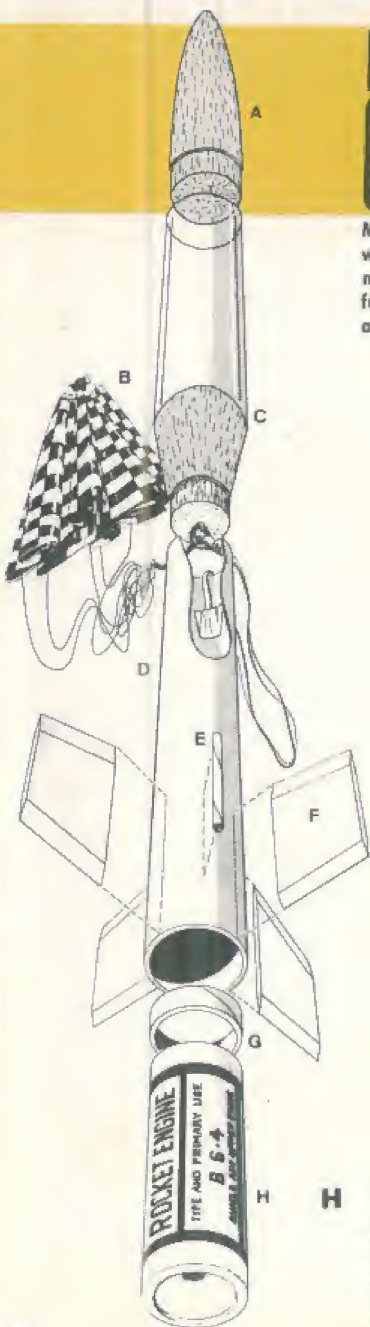
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# BASIC MODEL ROCKET COMPONENTS

Model rockets vary greatly in appearance and purpose, but whether for sport and recreation or scientific experiment, most models use certain basic components. The arrangement and functions of these components are explained in the diagram of a typical working rocket shown below.



## A NOSE CONE

The front end of a rocket. Usually shaped to minimize air resistance.

## B RECOVERY SYSTEM

Slows rocket descent, bringing it back to earth in an undamaged, reusable condition. In this model a parachute deployed by an ejection charge in the engine is used.

## C PAYLOAD SECTION

Used to carry instruments, specimens, etc. Some models may omit this section for sport or high-performance flights.

## D BODY TUBE

The basic airframe of the rocket, around which all other parts are built or attached.

## E LAUNCH LUG

A tube which slips over the launch rod to guide the model until it reaches the speed necessary for the fins to control the flight.

## F FINS

Act like the feathers on an arrow, guiding the rocket in a precise flight pattern.

## G ENGINE RETAINER

A block or ring used to position the engine in the body tube.

## H ENGINE

A pre-packaged solid propellant device which provides the power to make the rocket fly. Single and upper stage engines contain a smoke tracking/delay charge to let the model coast up to peak altitude before the ejection charge pops out the parachute.

# DESIGNING YOUR OWN ROCKETS...

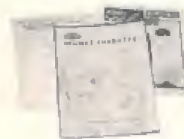
Model rockets are not toys. They are flying, miniature counter-parts of the vehicles of the space age. Constructed primarily of lightweight balsa and paper tubing, model rockets use and demonstrate principles of orbital launch and space vehicles.

Because their design and flight characteristics are similar to space rockets, model rockets present a way for young people of today to meet the challenge of the space age for tomorrow.

The ESTES program begins with basic model rockets which are easy to build and fly. Then as the model rocketeer's knowledge and skills develop the program provides more advanced and difficult rockets and projects. Throughout his "rocketry career" his success will be assured by the use of the safety-engineered ESTES solid propellant engines.

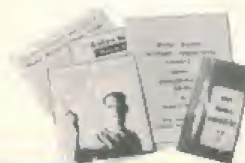
The most effective learning comes through doing. As a rocketeer develops skill and knowledge by building and flying rockets, he develops an active and inquiring mind. The ESTES program of model rocketry guides young people in this direction. This program is effective because it includes the finest rocketry materials available and a continuing flow of helpful information. Model rocketry as a form of youth science study has no equal for practical experience aimed at a space age career.

The future holds an exciting promise for young people who are prepared to meet its challenge. The greatest frontier man has ever known is opening. Young rocketeers are taking their first steps as pioneers in this great frontier.



## Technical Information Services

Rocketeers have a wealth of valuable information available from the Estes research department: New product innovations; information on new techniques; technical reports (TR's); and the informative and educational Model Rocket News, distributed free to customers.



## Educational Services Department

Headed by an experienced science teacher, this department provides many services to educators at all levels. Instructional materials are available at no cost to schools. As a teacher, please write your request on your school letterhead.

Through your studies and research you will learn that there is more to model rocketry than just the thrill of the launch. You will have discovered practical applications of the science subjects you've studied in school. You'll look forward to new fields to explore.

Look for research projects for your own research program. To assist you, several good books are listed in our catalog. Your school or public library has many more. Aerial photography, space medicine, electronics, aerodynamics, meteorology and physics are but a few of the fields open to ambitious model rocketeers.

Keep studying and researching. Use your studies to develop a prize winning project. Look to the future — the frontiers of space have barely opened. Curiosity and research of young people like yourself will expand these frontiers.



## DRAFTING AND DESIGNING EQUIPMENT



### TRIANGLE SET

Clear plastic triangles are perfect for drafting and designing work. Set includes one 6" 45° triangle and one 8" 30°-60° triangle. Beveled edges — accurate — precise . . . recessed lifts from both sides permit clean, easy pick-up. Shipping weight 6 oz.

Cat. No. 701-DT-2 . . . . . \$ .70 per set



### FRENCH CURVE

Precision-made with sleek-finished edges of hairline accuracy. Perfect for designing nose cones, plotting curves, etc. Shipping weight 4 oz.

Cat. No. 651-DC-1 . . . . . \$ .25



### PROTRACTOR

Large 6" clear plastic protractor makes angle measurements a "snap." Features sharp graduations, accurate 6" ruler at the base. Shipping weight 4 oz.

Cat. No. 651-DP-6 . . . . . \$ .15



### RULE

All purpose steel rule is graduated in inches on one edge and millimeters on the other to give fast, accurate measurements. Ideal both for design and construction work, this flexible stainless steel rule has a new non-slip backing for precise positioning. Shipping wt. 11 oz. Cat. No. 701-DR-3 . . . . . \$1.25 each



### 12" T-SQUARE

Precision-made, clear plastic 12 inch T-square is accurate and easy to use. Smooth straight edges are marked in inches and millimeters. Shipping weight 11 oz.

Cat. No. 701-DR-2 . . . . . \$ .35



### METAL COMPASS

Sheet metal German tool does double duty — can be used as pencil compass or divider. Includes metal capsule of leads. Shipping weight 4 oz.

Cat. No. 701-DC-2 . . . . . \$ .40



### BOW COMPASS

Giant bow compass features thumb screw adjustment, interchangeable points for use as divider, ink or pencil compass. Heavy gouge nickel plated steel. Shipping weight 6 oz.

Cat. No. 701-DC-3 . . . . . \$1.25

Let your model design win an award!

Enjoy designing new models?

- Payload •Duration •Boost-glide
- Launchers •Telemetry devices
- Odd-ball •or you name it



ENJOY \$  
IT MORE  
WITH A **50** MERCHANDISE AWARD

**ESTES**

DESIGN  
OF THE MONTH  
COMPETITION

Here's a contest for every rocketeer. You can get a lot more from it than just an award. Estes Industries sponsors this contest to encourage and reward original thinking among model rocketeers. Put your originality to the test. Enter soon!

NEW CONTEST EVERY MONTH . . . Send us your entries by mail!

All plans which reach Estes Industries during the calendar month will be considered for that month's award. Each month the winning designer will receive a \$50.00 merchandise coupon and an award suitable for framing. We will send an acknowledgement of each entry received but will not be able to enter into any other correspondence concerning entries.

DESIGN OF THE MONTH RULES ARE FEW . . . AND EASY TO FOLLOW

Entries will be judged on practicality, originality, neatness and clarity. Plans do not have to be flight tested and proven. However, a proven design is more apt to win. Launchers and other accessory items will also receive extra points if they have been field tested and results noted with entry. Photos are not required, but you may include a picture of your completed design if you wish.

**RULES:** 1. All entries become the property of Estes Industries; none can be returned.

2. Employees of Estes Industries and members of their immediate families are not eligible to enter.

3. Designs should be sent to the Design of the Month Editor, Estes Industries, Inc., Box 227, Penrose, Colorado 81240. However, all plans sent to us which are not specifically addressed to another contest or department will be automatically placed in the Design of the Month competition.

4. Any type of model rocketry design can be entered (rockets, boost-gliders, launching or recovery devices, etc.).

5. All designs reaching Estes Industries during the calendar month will be entered in that month's competition. (Date of receipt — not postmark — will determine the month in which a design will be judged.)

6. If two or more exceptional entries are received during any month, the judges may, at their discretion, make identical first-place awards or give additional special merit awards.

Award winners will be notified by mail. The name of the winner of each award will then be announced in the next issue of the Model Rocket News.

### A FEW TIPS IN PREPARING YOUR ENTRY

Designs should be new, original and different — but they also need to be workable. The goal is to develop something that other rocketeers can build and use successfully, too. If you're not sure your design will work, a little extra effort to make it work will be worth while. This way you gain additional engineering experience and also have a better chance to win.



## TECHNICAL REPORTS

**ROCKET STABILITY:** All about rocket stability. Easy to read, tells how to design your rockets to fly properly. No rocketeer will want to miss this one. Shipping weight 1 oz.

Cat. No. 651-TR-1.....\$ .25 each

**MULTI-STAGING:** Tells all about the latest discoveries in multi-staging technique. Complete, easy-to-understand and well illustrated. A necessity for designing, building and flying multi-stage birds. Shipping weight 1 oz.

Cat. No. 651-TR-2.....\$ .25 each

**ALTITUDE TRACKING:** The classic work on simple altitude tracking for model rocketeers. Thoroughly covers tracking and altitude computation. Easy to understand and apply. Shipping weight 1 oz.

Cat. No. 651-TR-3.....\$ .25 each

**REAR ENGINE BOOST-GLIDERS:** Basic information to help you understand the operation of rear-engine boost-gliders and design your own. Covers design and construction for proper upward flight and good glide characteristics. Shipping weight 1 oz.

Cat. No. 651-TR-4.....\$ .25 each

**BUILDING A WIND TUNNEL:** Full plans and information for building a wind tunnel to study rocket stability. Covers motor and handpowered versions, finding center of pressure, checking multi-stage rockets, etc. Great for clubs and experienced modelers — science fair projects too. Shipping weight 2 oz.

Cat. No. 651-TR-5.....\$ .25 each

**CLUSTER TECHNIQUES:** The complete report on clustering engines in model rockets. Thoroughly illustrated, easy to understand. Especially valuable for the modeler who wishes to loft larger payloads. Shipping weight 1 oz.

Cat. No. 651-TR-6.....\$ .25 each

**FRONT ENGINE BOOST-GLIDERS:** Valuable information on designing, building and flying front engine boost-gliders. Fully illustrated, recommended reading for anyone who wishes to build better gliders or get the best performance from the ones he has. Shipping weight 1 oz.

Cat. No. 651-TR-7.....\$ .25 each

**MODEL ROCKETRY STUDY GUIDE:** Presents a logical program for model rocketeers who want to get the most good from their activities. Includes a listing of recommended books on subjects relating to model rocketry. Shipping weight 1 oz.

Cat. No. 651-TR-8.....\$ .25 each

**DESIGNING STABLE ROCKETS:** Based on standard engineering practices, this report presents a method of designing rockets for proper stability on paper before any cutting or gluing is done. Worthwhile reading for beginner and experienced rocketeer alike. Shipping weight 1 oz.

Cat. No. 651-TR-9.....\$ .25 each

**ALTITUDE PREDICTION CHARTS:** Contains reports and graphs which explain a relatively simple method by which aerodynamic drag and other effects can be taken into account in predicting rocket peak altitudes. With this data the probable altitude can be determined for any rocket and any Estes engine, including multi-stage and cluster power. Includes suggestions for experiments. Shipping weight 3 oz.

Cat. No. 671-TR-10.....\$1.00 each

**AERODYNAMIC DRAG OF MODEL ROCKETS:** Written by Dr. Gerald M. Gregorek. Explores the basic concepts of aerodynamic drag. Shipping weight 1 oz.

Cat. No. 711-TR-11.....\$1.00 each



## BACK ISSUES

The MODEL ROCKET NEWS is a regular publication of Estes Industries featuring up-to-date information on developments in model rocketry, action articles on the science of rocketry, rocket plans and news about rocketeers and rocketeering. Current issues are distributed free to Estes customers. Back issues, an important source of rocketry ideas, are available at nominal cost in the bound volume groupings listed below.

**BEST OF VOLUMES 1 & 2** — Sixteen pages packed with the best ideas, plans and info condensed from Volumes 1 and 2. Includes Model Rocket Glossary, Idea Box features, information on underwater rockets. Technical Report TR-3, plans for Dirty Bird III and Bug-A-Bye, and interesting stories on the Crickenauts and "Guppies into Inner Space." Shipping weight 4 oz.

Cat. No. 651-MRN-1.....\$ .50

**VOLUMES 3 & 4** — Seven issues containing information on Science Fair projects, problem solvers from the Idea Box, altitude tracking information, safety tips, Technical Reports TR-2, TR-4, TR-6, TR-7. Included is information on basic construction, fins, sectional construction, chute cutting, chute recovery, booster recovery, rocket math and plans with parts lists for 12 different and exciting rockets. Shipping weight 6 oz.

Cat. No. 701-MRN-34.....\$1.00

**VOLUMES 5, 6, 7** — Six issues with comprehensive articles on many phases of model rocketry: electric launching systems; interesting R & D projects; model finishing; designing, turning and finishing nose cones; altitude and drag calculation techniques; streamer information; how to display models; information on our nation's large space boosters. Plans and parts lists for 8 new and unusual rockets, plus some "odd balls." Dozens of helpful hints from the Idea Box. Shipping weight 6 oz.

Cat. No. 701-MRN-567.....\$1.00

**VOLUMES 8 & 9** — Five issues with many informative, appropriately illustrated and easy-to-understand articles covering the science of rocketry. Included are explanations of Newton's 3rd law of motion, what keeps a satellite in orbit, why rockets are staged, the mathematics of altitude calculation and the orbital transport concept. Also a discussion of Metric vs. English system of measurements. More "how-to" helpers from the Idea Box and 9 new rocket plans and parts lists. Shipping weight 6 oz.

Cat. No. 701-MRN-89.....\$1.00

**MRN COLLECTION** — All the above volumes at a savings of 50¢. Shipping weight 24 oz.

Cat. No. 701-MRN-17.....\$3.00

**VOLUME 10-1** — Twelve pages of news on an indoor launch, the past decade of rocketry, measuring speed, notes and plans.

Cat. No. 711-MRN-V10-N1.....\$ .25

**VOLUME 10-2** — Features stories about Cinerac, acceleration against gravity, design tips and plans.

Cat. No. 711-MRN-V10-N2.....\$ .25



# BOOKS & LITERATURE

## SPACE AGE TECHNOLOGY (not shown at left)

Designed for classroom teaching of rocket history and concepts by using model rockets to capture student interest. 60 pages. Well illustrated. Written by two space scientist-engineers.

Cat. No. 711-BK-14..... Postpaid Price \$1.00

## DESIGN MANUAL

Make sure you have this up to date and authoritative model rocket design and plan manual. Contains complete plans for the Arrow-C, Orange Bullet and many other well-known and much-flown model rockets. Also includes basic tech reports and lots of information on rocket construction. Thoroughly illustrated, this is a "must" for all beginners and a good review and reference book for experienced rocketeers. Shipping wt. 4 oz.

Cat. No. 651-P-1..... Postpaid Price \$.50

## WHY MODEL ROCKETRY?

A 28 page booklet presenting clearly why model rocketry was developed. An ideal aid to explain your activities to a non-modeler. Shipping wt. 2 oz.

Cat. No. 651-BK-1..... Postpaid Price \$.20

## OUR ATMOSPHERE By Theo Loebsock

A fascinating account of the Earth's atmosphere — its spectacular phenomena, its riddles, wonders and effects on life and the world. Probably the most complete book available to the amateur weatherman. Shipping wt. 10 oz.

Cat. No. 671-BK-4..... Postpaid Price \$.75

## THE SEARCH FOR LIFE ON OTHER WORLDS

by Captain David C. Holmes, USN

A highly readable book exploring man's attempts to understand the origins of life and to detect life on other planets. Man's efforts to seek out life on other worlds are examined, and speculation as to the nature of that life are made. Shipping wt. 10 oz. Cat. No. 691-BK-8... Postpaid \$.95

## PROFILES OF THE FUTURE by Arthur C. Clarke

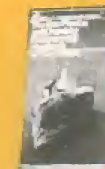
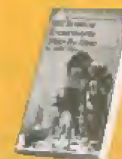
This book provides a fascinating view of the world of tomorrow. A carefully worked out series of predictions of what the future will be like. The science fiction ideas of today are logically extrapolated into the commonplace devices of tomorrow. Space laboratories, landing on Mars and many more developments are examined. Shipping wt. 10 oz.

Cat. No. 691-BK-9..... Postpaid Price \$.95

## THE EXPLORATION OF SPACE by Arthur C. Clarke

This analysis of the past, present, and future of space exploration is an exciting voyage into man's future by the co-author of the movie 2001: A Space Odyssey. The scientific principles involved in rocket flight are clearly explained. The environments of Earth's neighbors in space are examined. The design of spaceships is one of the many fascinating subjects covered in this excellent book. Shipping wt. 10 oz.

Cat. No. 691-BK-11..... Postpaid Price \$.75



## LEARN BASIC SLIDE RULE ON YOUR OWN

A Modern Programmed Instruction Manual: Prepared and tested by Cybern- Education, Inc., for Frederick Post Company; and Post 1447 slide rule and case.

This fine slide rule with A, B, C, D, C1, K, S, L and T scales comes complete with a durable plastic case. The instruction manual is an excellently written self-instruction manual featuring a tested and proven branching program type of programmed instruction. From beginners to experts desiring a brush-up course, this set provides an easy, quick, accurate way to learn how to use a slide rule on your own. Proceed as quickly or as slowly as you like. Adequate reviews and tests are built into the program. Shipping wt. 16 oz. Cat. No. 691-EK-1..... Postpaid Price \$6.00

## 150 SCIENCE EXPERIMENTS STEP-BY-STEP by Judith Viorst

Dozens of easy-to-perform experiments for the young scientist. Most experiments use only common household items. Learn by performing your own experiments in physics, chemistry, biology and mathematics. Build many functioning scientific devices such as electromagnets, barometers, sound-powered telephones, anemometers, stethoscopes and many others. Shipping wt. 10 oz.

Cat. No. 691-BK-7..... Postpaid Price \$.75

## THE NEW PHYSICS AND CHEMISTRY DICTIONARY AND HANDBOOK

by Robert W. Marks

This encyclopedia-type book provides a great variety of information in the physical and chemical sciences. This book is a handy reference for anyone interested in the physical sciences. Many useful reference tables are included in this practical study aid. Shipping wt. 10 oz.

Cat. No. 691-BK-10..... Postpaid Price \$1.20

## MODEL ROCKET LAUNCH SYSTEMS by R. L. Cannon

A learning guide written by Estes Industries' Educational Director. 21 pages presented in easy-to-understand language, covering launcher functions, multiple launchers, principles of electric circuits, electrical theory and mathematics, comprehensively illustrated.

Cat. No. 701-BK-12..... Postpaid Price \$.25

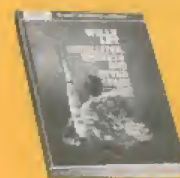
## SPACE FRONTIER by Wernher von Braun

A fascinating survey of what is happening and what we expect to achieve in our space program. Illustrated with diagrams and photos, it provides a proper understanding of the many facets of launch and space flight. Shipping wt. 10 oz. Cat. No. 691-BK-13..... Postpaid Price \$1.20

## SATELLITES, ROCKETS AND OUTER SPACE Revised with full Color Illustrations

Willy Ley provides the background necessary for an understanding of the fast moving developments in space exploration. He gives a clear and concise explanation of the basic theory and techniques of rocketry. The book's 128 pages are illustrated with both black and white drawings and color photos. Shipping wt. 10 oz.

Cat. No. 671-BK-6..... Postpaid Price \$.75







Estes offers the finest assortment of parts for building your own designs or modifying existing rockets.

## BUILDING WITH ESTES SUPPLIES



Just the handy odds-and-ends you always need — but rarely have

GET THIS

## BAG O'BALSA BLOCKS

You can build accessories for your launch pad. Make repairs. Customize. The handiest bag you'll ever find.

Shipping weight 15 oz.

Cat. No. 711-NCS-10 .....\$1.00



## ASSEMBLY SPECIAL

A Complete Construction  
and Finishing Set

One convenient package containing all the tools and supplies recommended for assembling, painting, and decorating most model rockets. Ideal for the beginner who doesn't already have modeling equipment. This set helps you build the best models right from the start.



- |                                      |   |                                |
|--------------------------------------|---|--------------------------------|
| 1 Bottle White Glue No. WG-1         | 1 Bottle Dope Thinner No. BDT-1         | 1 Knife No. KNS-3              |
| 3 Emery Boards No. BE-1              | 1 Bottle White Dope No. BRD-1           | 18 Sheets Sandpaper No. SPA-2  |
| 1 Bottle Sanding Sealer No. SS-1     | 1 Roll Masking Tape No. MT-1            | 3 Paint Brushes No. PB-3       |
| 1 Bottle Silver Dope No. BRD-1       | 1 Bottle Black Dope No. BRD-1           | 1 Bottle Orange Dope No. BRD-1 |
| 3 Sheets Sanding Material No. SP-320 | 1 Gold Mine Special Decal Sheet No. D-5 |                                |

Cat. No. 701-CK-3A, shipping wt. 1.5 lb. .... \$3.50



# MODELING KITS

**KNIFE CHEST:** Small, medium and heavy-duty knives plus 9 assorted extra blades — one for practically every cutting job. In a handy, natural finish wood chest. Shipping wt. 1 lb. 8 oz.  
Cat. No. 701-KNS-82 . . . . . \$4.95

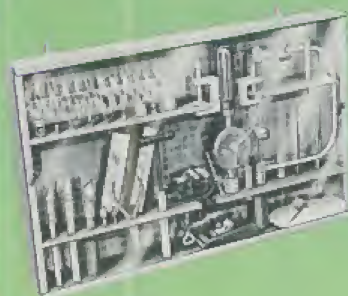


**KNIFE AND TOOL SET:** Contains small, medium and heavy-duty knives and an entire assortment of blades, gouges, routers, and punches. Has planer, 1" sander, spokeshave and balsa stripper. In wooden box, complete with see-through cover and fitted plastic tray insert that holds and shows every tool. Shipping wt. 2 lbs.  
Cat. No. 701-KNS-84 . . . . . \$13.50 each

**KNIFE SET:** Conveniently packaged in a clear plastic case, the set contains scribe and 9 assorted blades to take care of most cutting needs. Balanced, streamlined, light-weight aluminum handle. Shipping wt. 10 oz.  
Cat. No. 701-KNS-24 . . . . . \$3.00



**COMPLETE HOBBY DEN TOOL CABINET:** A truly complete tool set for the model rocketeer. Has a full assortment of hobby tools, knives and blades against a blueprint silhouette background of each tool for easy replacement. Comes in a sturdy wooden fitted cabinet with a sliding, see-thru cover. (Size 13 1/4 x 21 1/4 x 3"). Shipping weight 9 pounds.  
Cat. No. 701-KNS-88N . . . . . \$32.50 each



- |                                     |   |
|-------------------------------------|---|
| 6 Extra Blades                      | 1 Planer                                  |
| 6 Assorted Gouges                   | 1 Hammer (with extra heads)               |
| 4 Assorted Routers                  | 1 Bench Vise — imported                   |
| 2 Punches                           | 1 Pair Pliers — imported, service quality |
| 3 Knives (with blades)              | 1 Drill Bit, 2 Screw Driver Bits          |
| 1 Hobbycraft Saw (with extra blade) | 2 Razor Saw Blades                        |
| 2 Screw Drivers                     | 2 Chucks                                  |
| 2 "C" Clamps                        |   |
| 1 Tweezer                           |   |
| 1 Sander                            |   |
| 3 Tweezer Clamps                    |   |
| 1 Hand Drill                        |   |
| 1 File                              |   |

# MODELING TOOLS

**PRECISION KNIFE SET:** Includes one 4 1/4" long — 1 aluminum handle and one each — 1A cutting blade, — 1B punch blade, and — 1C gouge blade. Recommended for precision work. Shipping wt. 2 oz.  
CAT. NO. 651-KNS-1 — \$ .75 each

**RETRACTABLE BLADE KNIFE:** Heavy duty — 2 aluminum handle, 4 1/4" long, with one double ended — 2D blade. Blade retracts into handle for safe carrying. For general cutting. Shipping weight 4 oz.  
CAT. NO. 691-KNS-2 \$1.25 each

**HEAVY DUTY KNIFE:** Set of one 4 1/4" long — 4 plastic handle with metal chuck and one general purpose knife blade similar to — 4G. Shipping weight 6 oz.  
CAT. NO. 651-KNS-4 \$1.20 each

**UTILITY KNIFE:** Includes 5, 3, 6" long — 3 steel handle and one — 3E general purpose blade. Shipping weight 3 oz.  
CAT. NO. 651-KNS-3 \$ .30 each

# BLADES & ACCESSORIES

Fits — 1 handle only. For cutting balsa and paper.  
CAT. NO. 651-KNB-1A \$ .10 each

Fits — 1 handle only. Punch and scribes.  
CAT. NO. 651-KNB-1B \$ .25 each

Fits — 1 handle only. Gauge for holding balsa nose cones, adapters, blocks, etc.  
CAT. NO. 651-KNB-1C \$ .25 each

Fits — 2 and — 4 handles. For general cutting and trimming.  
CAT. NO. 651-KNB-4H \$ .15 each

Fits — 2 handle only. Double ended for general cutting.  
CAT. NO. 651-KNB-2D \$ .35 each

Fits — 2 and — 4 handles. For general cutting and carving.  
CAT. NO. 651-KNB-4G \$ .15 each

Fits — 2 and — 3 handles. Double ended for general cutting.  
CAT. NO. 651-KNB-3E \$ .15 each

For use with tool kits KNS-24, 82, 84, and 88N. The final blade shape for most every model rocket construction application.  
CAT. NO. 711-KNB-51 \$ .30 each



**WHETSTONE:** Keep knife blades extra sharp for easy cutting. Pocket size, 3 1/4" x 1/4" x 3/8". Use with oil for best results.  
Cat. No. 651-W1 . . . . . \$ .50



**TWEEZERS:** For 1,001 uses in handling small parts, attaching shock cords, etc. Steel, 3" long, 1/8" jaw. Shipping weight 2 oz.  
Cat. No. 701-T1 \$ .25 each

**EMERY BOARDS:** Perfect for cleaning micro-clips, shaping airfoils, turning nose cones, etc. 4 1/2" x 1 1/4", medium abrasive on one side, fine abrasive on the other. Shipping weight 1 oz.  
Cat. No. 701-BE1 . . . . . 3 for \$ 1.15



**RAZOR SAW:** Fits — 4 handle, 1" wide x 5" long. Use razor saw blade for cutting balsa and body tube.  
Cat. No. 701-KNB-4F . . . . . \$ .50 each

Shipping weight on saw blade is 6 oz. all other blades, 1 oz.



# FINISHING SUPPLIES

For model finishing information, see page 76



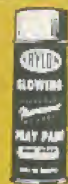
**ASTROSEAL** balsal filler: The first step to a perfect finish. Astroseal contains an extra high percentage of selected fillers to completely fill the grain in balsal parts. Gives smooth surface for dope or enamel application. Brush on two to four coats, letting each dry thoroughly. Sand with #SP320 sanding material between coats. In four ounce jar. Shipping weight 7 oz.

Cat. No. 701-SS-2 ..... \$ .80



**HEAT RESISTANT PAINT:** Protect exposed rocket parts from heat damage with easy-to-apply, brush-on, high heat aluminum paint. Protects to 1000°, gives a bright metallic finish. Recommended for swept fins and other parts exposed to hot exhaust gases. In 1½ ounce bottles. Shipping weight 6 oz.

Cat. No. 651-AP-1 ..... \$ .35



**FLUORESCENT SPRAY PAINT:** The brightest colors anywhere — make rockets easy to spot in the air and on the ground. Glowing, high visibility paint comes in handy 6 oz. spray cans, dries in minutes. For maximum brilliance use glossy white enamel as an undercoat. Available in Cerise Red, Yellow Orange, Red Orange and Green. Specify colors when ordering. Shipping weight 16 oz. each.

Cat. No. 651-FP-1 ..... \$1.40



**ENAMEL SPRAY PAINT:** Get that "professional" appearance for your best models. Top quality enamel in handy 5 oz. spray cans dries in minutes. Use indoors and outdoors. Not fluorescent. Available in the popular colors of True Blue, Bright Silver, Bright Gold, Cherry Red, Glossy White, Glossy Black, Flat White, Ultra Flat Black. Specify colors when ordering. Shipping weight 16 oz. each.

Cat. No. 651-EP-1 ..... \$1.20



**CLEAR SPRAY:** Crystal clear spray coating goes on clear — stays clear. Gives extra gloss to enamel finishes, protects decals and decorations, makes fluorescent finishes smooth, durable and glossy. For best results, let paint dry thoroughly before applying clear spray, use several light coats for maximum gloss. In handy 5 oz. spray can. Shipping weight 16 oz.

Cat. No. 651-EP-2 ..... \$1.20



**BUTYRATE DOPE:** The dope preferred by expert modelers for perfect finishes. Brushes on smoothly, easily, comes in convenient 1 oz. bottles. Available in Insignia Red, International Orange, Dark Green, Gloss Black, Insignia White, True Blue, Sky Blue, Aircraft Gray, Orange Yellow, Silver, Gold and Clear. Specify colors when ordering. Shipping wt. 4 oz.

Cat. No. 701-BRD-1 ..... \$ .25

**SANDING SEALER:** Fills small holes in balsal, paper and other porous materials, provides a smooth surface for paint or dope. To use, sand the surface, brush on sealer, let dry and sand again. Repeat as needed to obtain a glass-like surface. In 1 ounce bottles. Shipping weight 4 oz.

Cat. No. 701-SS-1 ..... \$ .25

**THINNER:** For diluting butyrate dope, sanding sealer and Astroseal and for brush cleaning. Completely colorless — won't interfere with the drying action of the dope. Comes in 1 ounce bottles. Shipping weight 4 oz.

Cat. No. 701-BDT-1 ..... \$ .25

**WHITE GLUE:** Preferred for rocket building! Sets fast, gives super strong joints with wood, paper, cloth and other porous materials. In 2 ounce plastic squeeze bottle. Shipping weight 6 oz.

Cat. No. 701-WG-1 ..... \$ .50

**BODY PUTTY:** For super-sleek models. Fill cracks, holes, grain marks in balsal parts, make smooth fin-body joints. In 21 cc. tube. Shipping weight 5 oz.

Cat. No. 651-FM-1 ..... \$ .30

**FINISHING WAX:** For the high gloss finish so important to appearance and low drag. Apply with soft cloth, let dry and polish with a soft, dry cloth. Recommended for use on enamel and butyrate finishes only. In 2 ounce jar. Shipping weight 5 oz.

Cat. No. 701-FW-2 ..... \$ .85

**SANDING MATERIAL:** Fold, roll or crumple it for hard to reach places. Special mylar plastic backed abrasive sheet can be used over and over again. Helps you get a mirror finish. Extra fine 320 grit in easy to handle 2½" x 2¼" sheets. Shipping weight 1 oz.

Cat. No. 651-SP-320 ..... 3 sheets \$ .10

**SANDPAPER:** Shape and smooth model rocket parts with these handy 3" x 3" sheets of top quality sandpaper. Available in three grades. Specify grade when ordering. Shipping weight 1 ounce for 6 sheets.

6 SHEETS MEDIUM — Cat. No. 651-SPM-2 ..... \$ .10

6 SHEETS FINE — Cat. No. 651-SPF-2 ..... \$ .10

6 SHEETS EXTRA FINE — Cat. No. 651-SPEF-2 ..... \$ .10

18 SHEETS ASSORTED (6 each) — Cat. No. 651-SPA-2 ..... \$ .25

**PAINT BRUSHES:** The set designed for model rocketry. You get one #1 brush for extra fine work, one #4 brush for normal work and one #6 brush for covering large areas rapidly. Brushes are 6" long with quality camel hair bristles set in nicked ferrules. Available in sets of three only. Shipping weight 2 oz.

Cat. No. 691-PB-3 ..... \$ .35

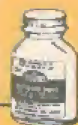
## STYRENE CEMENT:

**BOTTLE** — for cementing plastic to plastic. Shipping wt. 3 oz.

Cat. No. 711-PC-1 ..... \$ .29

**TUBE** — for cementing plastic to other materials. Shipping wt. 1¼ oz.

Cat. No. 711-PC-2 ..... \$ .15





# custom assortments

Many new, unique and useful rocket designs have been produced by imaginative rocketeers. In this section you'll find representative money-saving assortments of components for the beginner and for the experienced rocketeer who wants to explore new designs and ideas.

## LAUNCH PAD SPECIAL

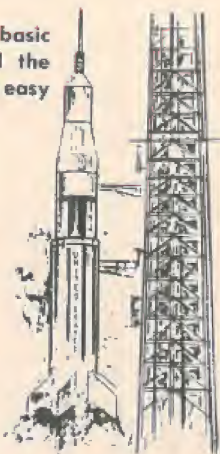
**\$10.14 VALUE ONLY \$5.50!**

Perfect starter assortment for a basic foundation. Designed around the durable BT-30 body tube . . . for easy to build, long-lasting "birds."

Contains all parts and supplies necessary for the experimentally minded rocketeer to explore techniques of successful rocket building. A comprehensive design manual guides you to hours of fun and satisfaction in building serviceable rockets. A good basic assortment for studies in aerodynamics, stability and recovery techniques.

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box.

Cat. No. 701-ES-55, shipping wt. 1 lb., 14-oz. . . . \$5.50



**BODY TUBES**  
6 Body Tubes #BT-30

**NOSE CONES**  
2 Nose Cones #BNC-30C  
1 Nose Cone #BNC-30D  
1 Nose Cone #BNC-30E  
1 Nose Cone #BNC-30M  
1 Nose Cone #BNC-30N

**RECOVERY EQUIPMENT**  
2 Parachutes #PK-12A  
1 Parachute #PK-8A  
1 Parachute Material #PM-2  
1 Streamer Material #SM-1  
1 Sheet Tape Strips #TD-2  
1 Roll Shroud Lines #SLT-1  
6 Shock Cords #SC-1  
6 Screw Eyes #SE-2

**FIN MATERIAL**  
4 Balsa Fin Stock #BFS-20  
2 Balsa Fin Stock #BFS-30

**MISCELLANEOUS**  
6 Engine Blocks #EB-30A  
3 Launch Lugs #LL-2C  
1 Design Manual #P-1  
1 Fin Pattern Sheet #PP-2  
1 Fin Pattern Sheet #PP-3



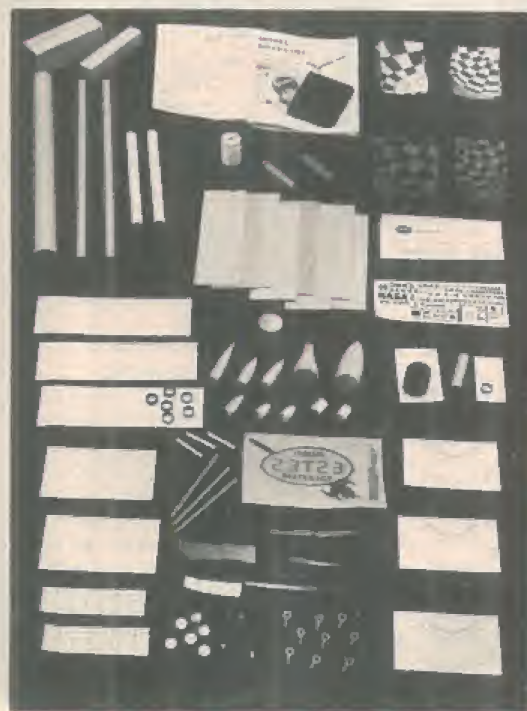
## LIFT-OFF SPECIAL

**\$17.30 VALUE ONLY \$11.00!**

**FOR  
BUILDING AN  
ALL-PURPOSE  
ROCKET  
FLEET**

Cat. No. 701-ES-110 . . . . . \$11.00

Lift-off to more rocket building enjoyment with this special-value assortment. A balanced selection of parts and supplies to build and decorate many different types of rockets. Real savings. Great for gifts, or for yourself as you build advanced or experimental models. Shipping wt. 2 lbs., 5 oz.



### NOSE CONES

1 #BNC-60L 1 #BNC-20B  
1 #BNC-30E 1 #BNC-20N  
1 #BNC-30M 1 #BNC-10A  
1 #BNC-20A 1 #BNC-10B

### FIN MATERIAL

1 Balsa Sheet #BFS-10  
2 Balsa Sheets #BFS-20  
3 Balsa Sheets #BFS-30  
2 Balsa Sheets #BFS-40

### BODY TUBES

1 #BT-60 2 #BT-20  
2 #BT-30 2 #BT-10H

### BULKHEADS AND HOLDERS

1 #NB-60 3 #EB-30A  
1 #NB-30 3 #EB-20A  
1 #NB-20 1 #EH-2060

### RECOVERY EQUIPMENT

1 Parachute #PK-8A  
2 Parachutes #PK-12A  
1 Parachute #PK-18A  
1 Parachute #PK-24A  
1 Parachute Material #PM-2  
1 Streamer Material #SM-1  
2 Sheets Tape Strips #TD-2  
1 Roll Shroud Lines #SLT-1  
3 Snap Swivels #SV-12  
9 Screw Eyes #SE-1  
6 Shock Cords #SC-1  
1 Shock Cord #SC-2

### MISCELLANEOUS

1 Balsa Adapter #TA-2060  
1 Adapter Set #TA-1  
1 Nose Cone Stock #NCS-1  
1 Nose Cone Stock #NCS-2  
3 Nose Cone Dowels #NCD-1  
6 Nose Cone Weights #NCW-1  
3 Reinforcing Mat'l. #PRM-1  
3 Launching Lugs #LL-2C  
1 Decal Sheet #D-5  
1 Design Manual #P-1  
1 Fin Pattern Sheet #PP-2  
1 Fin Pattern Sheet #PP-3

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box.



# ORBIT SPECIAL

Shipped in a sturdy field box with handle and compartments for engines, supplies, tools, etc. Ideal range box.

You or your club members will "orbit" a whole host of rockets before this value-packed assortment has been used. With the representative selection of parts and supplies included, your imagination will have a chance to run free on many rocket projects and experiments. Valuable design manual included. Shipping weight 2 lbs. 9 oz.

Cat. No. 701-ES-165 ..... \$16.50



## NOSE BLOCKS, ENGINE BLOCKS, HOLDERS, ETC.

- 1 Nose Block #NB-60
- 1 Nose Block #NB-50
- 1 Nose Blocks #NB-30
- 2 Nose Blocks #NB-20
- 3 Engine Blocks #EB-30A
- 3 Engine Blocks #EB-20A
- 1 Engine Mount #EH-2050
- 1 Engine Mount #EH-2060
- 1 Stage Coupler #JT-50C
- 1 Stage Coupler #JT-60C

## RECOVERY EQUIPMENT

- 1 Parachute Material #PM-2
- 2 Parachutes #PK-8A
- 3 Parachutes #PK-12A
- 2 Parachutes #PK-18A
- 1 Parachute #PK-24A
- 3 Streamer Material #SM-1
- 2 Sheets Tape Strips #TD-2
- 1 Roll Shroud Lines #SLT-1
- 6 Shock Cords #SC-1
- 3 Shock Cords #SC-2
- 12 Screw Eyes #SE-1
- 3 Snap Swivels #SV-12

**\$23.50 VALUE  
ONLY \$16.50**

## BODY TUBES

- 1 #BT-60
- 1 #BT-50
- 3 #BT-30
- 2 #BT-20
- 2 #BT-10H

## NOSE CONES

- 1 #BNC-60L
- 1 #BNC-50K
- 1 #BNC-30D
- 1 #BNC-30E
- 1 #BNC-30M
- 1 #BNC-20A
- 1 #BNC-20B
- 1 #BNC-20N
- 1 #BNC-10A
- 1 #BNC-10B

## ADAPTERS

- 1 Balsa #TA-2050A
- 1 Balsa #TA-2060
- 1 Balsa #TA-5060
- 1 Paper #TA-1

## FIN MATERIAL

- 3 Balsa Sheets #BFS-10
- 3 Balsa Sheets #BFS-20
- 3 Balsa Sheets #BFS-30
- 3 Balsa Sheets #BFS-40

## MISCELLANEOUS

- 1 Payload Section #PS-20A
- 1 Nose Cone Stock #NCS-1
- 1 Nose Cone Stock #NCS-2
- 3 Nose Cone Dowels #NCD-1
- 6 Nose Cone Weights #NCW-1
- 3 Reinforcing Mat'l. #PRM-1
- 1 Reinforcing Mat'l. #GR-2
- 6 Launching Lugs #LL-2C
- 1 Decal Sheet #D-5
- 1 Decal Sheet #D-6
- 1 Design Manual #P-1
- 1 Fin Pattern Sheet #PP-2
- 1 Fin Pattern Sheet #PP-3

**\$10.60 VALUE  
ONLY \$7.00**

# RANGE KIT SPECIAL



A sturdy, all metal range box (RB-1), loaded with all these most needed items:

- |                      |                                     |                     |                      |
|----------------------|-------------------------------------|---------------------|----------------------|
| 21 Igniters          | 1 Roll Shroud Lines                 | 3 Screw Eyes        | 1 Engine Holder      |
| 1 Bottle White Glue  | 1 Sheet Tape Strips                 | 3 Nose Cone Weights | 1 Reinforcing Mat'l. |
| 1 Knife Handle       | 2 Packs Flameproof Recovery Wadding | 1 Roll Masking Tape | 3 Snap Swivels       |
| 3 Knife Blades       | 4 Parachutes                        | 2 Balsa Fin Stock   | 4 Shock Cords        |
| 1 Tweezers           | 1 Streamer Material                 | 3 Launching Lugs    | 1 Emery Board        |
| 5 Flight Data Sheets |                                     | 18 Sheets Sandpaper | 2 Micro-Clips        |

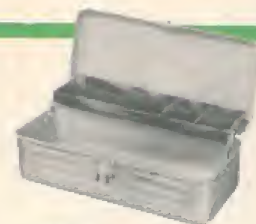
Shipping weight 2 lbs. 13 oz. Sorry, no substitutions.

Cat. No. 701-RBK-1 ..... \$7.00

## RANGE BOX

Good-looking, roomy, tough all-metal box — the same as included with the special above. A big 11½" x 5¼" x 4", complete with a three compartment tray for small parts. Has full-drawn seamless body, snap latch with eye for padlock. Shipping weight 2 pounds.

Cat. No. 701-RB-1 ..... \$3.00



## LARGE RANGE BOX

Big enough to hold an Altiscope, an Electro-Launch and a model or two, this sturdy all steel range box measures 19" x 7¼" x 6". Watertight construction protects your supplies, double action latch eliminates spilling, multi-section tray helps keep things organized. Shipping weight 6 pounds.

Cat. No. 701-RB-2 ..... \$7.00



## LARGE RANGE KIT SPECIAL

Includes the large range box with the same supplies as the regular range kit special. Shipping weight 7 lb.

Cat. No. 701-RBK-2 ..... \$11.00

**\$14.60 VALUE  
ONLY \$11.00**



## FOR BUILDING ROCKETS OF YOUR OWN DESIGN

Cat. No.	Price Each	Length	Inside Diameter	Outside Diameter	Wall Thickness	Wt. in Ounces Net	Wt. in Ounces Ship.
<b>BT-5, Spiral-Wound Paper Tube, for nose sections and strap-on payloads</b>							
651-BT-5	\$ .30	18"	0.515"	0.541"	0.013"	.219	11
651-BT-5P	\$ .15	5.1"	0.515"	0.541"	0.013"	.062	4
<b>BT-10, Mylar Plastic Tube, for featherweight models</b>							
701-BT-10	\$ .30	9"	0.710"	0.720"	0.005"	.088	4
701-BT-10H	\$ .15	3.062"	0.710"	0.720"	0.005"	.029	1
<b>BT-20, Spiral-Wound Paper Tube, for competition and sport models</b>							
651-BT-20	\$ .30	18"	0.710"	0.736"	0.013"	.288	11
651-BT-20B	\$ .15	8.65"	0.710"	0.736"	0.013"	.136	4
651-BT-20D	\$ .15	6.5"	0.710"	0.736"	0.013"	.104	4
651-BT-20G	\$ .10	3.5"	0.710"	0.736"	0.013"	.056	4
651-BT-20J	\$ .10	2.75"	0.710"	0.736"	0.013"	.044	4
651-BT-20M	\$ .10	2.25"	0.710"	0.736"	0.013"	.036	4
<b>BT-30, Parallel-Wound Paper Tube, for sport models</b>							
701-BT-30	\$ .30	9"	0.725"	0.765"	0.021"	.270	4
651-BT-30F	\$ .25	7"	0.725"	0.765"	0.021"	.210	4
651-BT-30B	\$ .20	6.125"	0.725"	0.765"	0.021"	.184	4
651-BT-30C	\$ .20	5.5"	0.725"	0.765"	0.021"	.165	4
651-BT-30A <sup>*</sup>	\$ .30	3.5"	0.725"	0.765"	0.021"	.105	4
701-BT-30J	\$ .15	2.75"	0.725"	0.765"	0.021"	.082	4
<b>BT-50, Spiral-Wound Paper Tube, for sport and high performance payload models</b>							
651-BT-50	\$ .40	18"	0.950"	0.976"	0.013"	.378	11
701-BT-50L	\$ .35	12.7"	0.950"	0.976"	0.013"	.242	5
701-BT-50W	\$ .30	9.5"	0.950"	0.976"	0.013"	.200	5
651-BT-50H	\$ .25	7.75"	0.950"	0.976"	0.013"	.163	4
701-BT-50S	\$ .20	4"	0.950"	0.976"	0.013"	.084	4
651-BT-50J	\$ .15	2.75"	0.950"	0.976"	0.013"	.058	4
<b>BT-55, Spiral-Wound Paper Tube, for sport and demonstration models</b>							
701-BT-55	\$ .60	18"	1.283"	1.325"	0.021"	.672	11
701-BT-55V	\$ .55	16.35"	1.283"	1.325"	0.021"	.687	11
651-BT-55S	\$ .20	4"	1.283"	1.325"	0.021"	.268	4
<b>BT-60, Spiral-Wound Paper Tube, for sport and demonstration models</b>							
701-BT-60	\$ .65	18"	1.595"	1.637"	0.021"	.960	11
701-BT-60D	\$ .50	11"	1.595"	1.637"	0.021"	.583	11
651-BT-60K	\$ .35	7"	1.595"	1.637"	0.021"	.371	6
651-BT-60R	\$ .25	5"	1.595"	1.637"	0.021"	.265	6
651-BT-60J	\$ .15	2.75"	1.595"	1.637"	0.021"	.146	6
<b>BT-70, Spiral-Wound Paper Tube, for monster models and tail rings</b>							
651-BT-70	\$ .85	17.5"	2.175"	2.217"	0.021"	1.30	14
<b>BT-101, Spiral-Wound Paper Tube, for general purpose models.</b>							
711-BT-101	\$1.75	16 1/2"	3.896"	3.938"	0.021"	1.974	16
<b>Clear Plastic Tubes — for payload sections</b>							
651-PST-20	\$ .30	8"	0.710"	0.736"	0.013"	.168	4
651-PST-20J	\$ .15	2.75"	0.710"	0.736"	0.013"	.058	4
701-PST-50S	\$ .25	4"	0.950"	0.976"	0.013"	.110	4
701-PST-60R	\$ .50	5"	1.595"	1.637"	0.021"	.350	6
701-PST-65R	\$ .55	5"	1.750"	1.796"	0.023"	.450	6

\*Replacement part for the Astron Scout, with holes punched. Be sure to give catalog number and length when ordering body tubes.



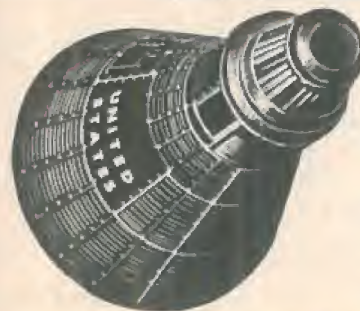
## PAYLOAD SECTIONS

Ideal for payload launchings! Carry instruments, biological specimens, etc., in these light-weight, high capacity payload sections. These capsules come complete with all needed parts, including nose cone, body tube, nose block or adapter and screw eye.

Cat. No.	Price Each	Body Mat'l.	Weight oz.		Fits	Inside Dia.	Inside Length	Overall Length
			Net	Ship.				
651-PS-20A	\$ .80	Clear Plastic	.16	1	BT-20	.718"	2"	4"
651-PS-20C	\$ .85	Clear Plastic	.40	4	BT-20	.950"	3"	7"
651-PS-30B	\$ .65	Regular Tube	.24	1	BT-30	.725"	2"	3.75"
651-PS-50A	\$ .90	Clear Plastic	.39	4	BT-50	.950"	3"	6.50"
651-PS-50B	\$ .85	Regular Tube	.36	4	BT-50	.950"	3"	6.50"
701-PS-50C	\$1.60	Clear Plastic	1.0	11	BT-50	1.59"	4"	10.5"
701-PS-50D	\$1.50	Regular Tube	.95	11	BT-50	1.59"	4"	10.5"
701-PS-50E	\$1.75	Clear Plastic	1.1	11	BT-50	1.75"	4"	10.5"
701-PS-55B	\$1.25	Regular Tube	.53	11	BT-55	1.28"	3"	7.63"
701-PS-60A	\$1.60	Clear Plastic	.98	11	BT-60	1.59"	4"	9.50"
701-PS-60B	\$1.50	Regular Tube	.90	11	BT-60	1.59"	6"	10.5"
701-PS-60C	\$1.75	Clear Plastic	1.0	11	BT-60	1.75"	4"	9.50"

## MERCURY CAPSULE

PERFECT FOR PAYLOADS. Add a special touch to your rockets. Get this model Mercury Capsule. A big 1.8 inches in diameter and 3.2 inches high, this capsule is equipped with a removable base for easy payload access. Comes in easy to assemble kit form with a full set of adapters to fit the capsule to most Estes body tubes. Makes an ideal display model too. Shipping weight 3 ounces.



Cat. No. 651-PSM-1 \$1.00





Made of lightweight balsa, Estes nose cones are accurately machined to give you smooth surfaces, snug fit and uniformity.

## NOSE CONES



Nose cone dimensions on opposite page - columns 1, 2 and 3.

### BALSA BLOCKS FOR MAKING NOSE CONES OF YOUR OWN DESIGN



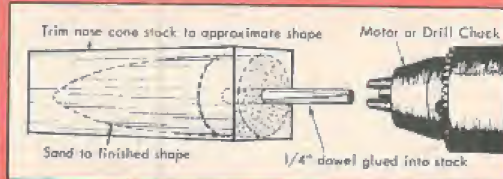
You can order nose cone stock in 4" to 6" lengths, perfect for turning your own nose cone shapes. These are cut-off pieces from our manufacturing process. Slightly damaged corners will not interfere with their usability. WITH EACH BLOCK ORDERED, ESTES INCLUDES A NOSE CONE DOWEL, NCD-2.

1" x 1" blocks, shipping wt. 1 oz.  
Cat. No. 691-NCS-1A.....ea. \$ .15

2" x 2" blocks, shipping wt. 3 oz.  
Cat. No. 691-NCS-2A.....ea. \$ .20

**NOSE CONE DOWELS:** 1/4" dia. x 2" long, hardwood. Use dowels as shown in drawing for making nose cones.

Shipping weight 2 oz.  
Cat. No. 651-NCD-2.....3 for \$ .10



**SUGGESTION:** When designing rockets using light-weight nose cones, be sure to follow procedures in TR-1 on rocket balance and stability. Don't forget to order screw eyes and nose cone weights. See pages 131 and 138.

## Precision made for finer performance

Catalog No.	Price Each	Dimensions			Average Weight	Ship Weight
		1	2	3		
LIGHTWEIGHT GEMS FOR BT-5						
651-BNC-5V	\$ .25	3/4"	0.541"	1/4"	0.013 oz.	1 oz.
651-BNC-5E	\$ .25	1 3/8"	0.541"	1/4"	0.020 oz.	1 oz.
651-BNC-5S	\$ .25	1 1/2"	0.541"	1/4"	0.016 oz.	1 oz.
651-BNC-5W	\$ .40	2 7/8"	0.541"	1/4"	0.039 oz.	2 oz.
PERFECT FOR BT-10						
651-BNC-10A	\$ .25	13/16"	0.728"	1/4"	0.03 oz.	1 oz.
701-BNC-10B	\$ .30	1 11/16"	0.728"	5/16"	0.05 oz.	1 oz.
VARIETY FOR A BT-20						
651-BNC-20A	\$ .25	13/16"	0.736"	1/4"	0.03 oz.	1 oz.
701-BNC-20P	\$ .40	1 5/16"	0.900"	7/16"	0.07 oz.	4 oz.
701-BNC-20B	\$ .30	1 11/16"	0.736"	5/16"	0.05 oz.	1 oz.
651-BNC-20R	\$ .40	2 3/4"	0.736"	3/8"	0.07 oz.	2 oz.
651-BNC-20N	\$ .45	2 3/4"	0.736"	1/2"	0.08 oz.	2 oz.
BALSA BEAUTIES FOR BT-30						
651-BNC-30C	\$ .30	3/4"	0.767"	3/8"	0.04 oz.	1 oz.
701-BNC-30D	\$ .35	1 1/2"	0.767"	3/8"	0.06 oz.	1 oz.
651-BNC-30M	\$ .40	1 1/2"	0.767"	1/2"	0.06 oz.	1 oz.
701-BNC-30E	\$ .45	2 3/16"	0.767"	7/16"	0.07 oz.	1 oz.
701-BNC-30N	\$ .50	2 3/4"	0.767"	1/2"	0.08 oz.	2 oz.
DESIGNED FOR THE BT-50						
651-BNC-50J	\$ .40	1 3/8"	0.976"	1/2"	0.08 oz.	4 oz.
701-BNC-50K	\$ .50	2 3/4"	0.976"	1/2"	0.13 oz.	4 oz.
701-BNC-50X	\$ .60	3 1/4"	0.976"	1/2"	0.15 oz.	4 oz.
671-BNC-50AD	\$ .75	4 1/16"	1.300"	1/2"	0.25 oz.	6 oz.
651-BNC-50Y	\$ .75	4 3/8"	0.976"	3/8"	0.16 oz.	6 oz.
JUST RIGHT FOR THE BT-55						
651-BNC-55AA	\$ .75	3 1/8"	1.325"	1/2"	0.15 oz.	4 oz.
701-BNC-55F	\$ .80	3 7/8"	1.325"	1/2"	0.19 oz.	4 oz.
701-BNC-55AC	\$ .90	5 3/8"	1.325"	3/8"	0.32 oz.	6 oz.
711-BNC-55AD	\$ .90	5"	1.325"	3/4"	0.43 oz.	4 oz.
EXCLUSIVELY FOR THE BT-60						
701-BNC-60AB	\$ .75	2 5/8"	1.637"	3/8"	0.23 oz.	4 oz.
651-BNC-60T	\$ .75	2 7/8"	1.637"	1/2"	0.17 oz.	4 oz.
651-BNC-60L	\$ .75	3 1/8"	1.637"	5/8"	0.34 oz.	4 oz.
681-BNC-60AH	\$ 1.50	7 1/4"	1.637"	7/8"	1.0 oz.	6 oz.
IDEAL FOR THE PST-65						
701-BNC-65L	\$ .85	3 1/4"	1.796"	1/2"	0.41 oz.	4 oz.
FITS THE BT-70						
681-BNC-70AJ	\$ 1.50	4 1/4"	2.217"	1"	0.85 oz.	6 oz.
ESPECIALLY FOR OUR ENGINE MAILING TUBE						
701-BNC-MTD	\$ .40	1 1/2"	1.002"	3/8"	0.06 oz.	4 oz.
AND A TAIL CONE FOR BT-55 (with pre-drilled hole)						
701-BTC-55Z	\$ 1.00	3"	1.325"	1/2"	0.25 oz.	4 oz.





## RECOVERY EQUIPMENT & SUPPLIES

**PARACHUTE KITS:** Get the best in parachute recovery! Two color printed plastic 'chutes give maximum visibility — feature easy-to-see pattern. Lightweight, durable and easily folded, these 'chutes are only 0.00075" thick, allowing the most material to be packed into the least body space. Each kit comes complete with 'chute material, tape strips and shroud lines.

Shipping weight 2 oz.

Cat. No.	Parachute Diameter	Color Combinations Available	Net Weight	Price Each
701-PK-8	8 inches	Orange and White	.035 oz.	\$ .25
701-PK-12	12 inches	Red and White Red and Yellow Yellow and Black Orange and Black	.078 oz.	\$ .25
701-PK-18	18 inches	Red and White Red and Yellow Orange and Black	.144 oz.	\$ .35
701-PK-24	24 inches	Red and White Orange and Black	.298 oz.	\$ .50

**PARACHUTE MATERIAL:** You get a big square yard of extra strength, high visibility black plastic 'chute material. Each sheet can be cut to make one or more round or square parachutes up to 36" across. Net weight .98 oz. Shipping weight 5 oz.

Cat. No. 701-PM-2 . . . . . \$ .50 each

**ALUMINIZED PARACHUTE MATERIAL:** Fire-resistant, extra strong coated polyethylene. 3 feet x 3 feet. 1.25 mil. thick. Shipping weight 2 oz.

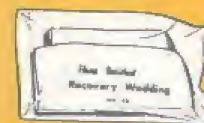
Cat. No. 711-PM-3 . . . . . \$ .75 each

**STREAMER MATERIAL:** Bring light weight models back to earth with bright orange, flame resistant crepe paper streamers. In 7½-foot lengths, enough for two to eight streamers. Available in 1" and 2" widths. Specify size when ordering. Shipping weight 1 oz.

1" wide — Net wt. .092 oz. Cat. No. 651-SM-1 . . . . . 3 for \$ .30

2" wide — Net wt. .184 oz. Cat. No. 651-SM-2 . . . . . 3 for \$ .40

**RECOVERY WADDING:** Extra soft and flexible, light weight tissue paper (bathroom type), specially treated to make it flame resistant. Gives the very best protection from hot ejection gases for parachutes and streamers. Each package contains approximately 75 4½" squares — enough wadding for up to 25 flights. Instructions included in package. Shipping weight 6 oz. Cat. No. 701-RP-1A . . . . . \$ .40



**SHROUD LINES:** Build reliable, durable custom parachutes with this strong, hard surface shroud line cord. Comes in 72 yard spools. Shipping weight 5 oz.

Cat. No. 701-SLT-1 . . . . . \$ .35



**SCREW EYES:** Attach recovery systems to nose cones or nose blocks with these light weight metal screw eyes. Available in three sizes, specify size when ordering. Shipping weight for 3 eyes 1 oz.

LARGE EYE: 1" long; .04 oz.; Cat. No. 651-SE-1 3 for \$ .10

SMALL EYE: ¾" long; .03 oz.; Cat. No. 651-SE-2 3 for \$ .10

EXTRA SMALL

EYE: ⅝" long; .01 oz.; Cat. No. 651-SE-3 3 for \$ .10



**TAPE DISCS:** Fasten shroud lines to plastic 'chutes or streamers with these ¾" pressure sensitive tape discs. Shipping weight for 12 discs, 1 oz.

Cat. No. 651-TD-1 . . . . . 12 for \$ .15



**TAPE STRIPS:** For top strength, low bulk and low weight, fasten shroud lines with these ¼" x ¾" tape strips. In sheets of 35 strips, shipping weight 1 oz.

Cat. No. 651-TD-2 . . . . . \$ .30 per sheet



**SHOCK CORD:** Convenient 18" lengths of model airplane contest rubber to absorb shock of ejection and recovery system deployment. In ⅛" widths for normal models, ¼" widths for heavy rockets. Specify width when ordering. Both are .03" thick. Shipping weight 1 oz.

⅛" wide: Net wt. 0.039 oz., Cat. No. 671-SC-1 . . . \$ .10

¼" wide: Net wt. 0.078 oz., Cat. No. 671-SC-2 . . . \$ .15

Also 36" long for greater stretch on those larger birds.

⅛" wide: Net wt. 0.078 oz., Cat. No. 681-SC-3 . . . \$ .20



**SNAP SWIVELS:** For quick changes and reduced tangling in your recovery systems, use these tiny 1" long snap swivels. Net weight .01 oz. Shipping weight for 6 swivels 1 oz.

Cat. No. 701-SV-12 . . . . . 6 for \$ .25





## LIGHTWEIGHT PRECISION MADE PARTS for building your own rockets

### NOSE BLOCKS

Use these top quality, lightweight balsa nose blocks in payload sections and anywhere else a solid bulkhead is required. Precision turned for exact fit in body tubes.



Catalog No.	Price Each	Outside Diameter	Length	Fits	Weight oz. Net	Ship.
651-NB-20	\$.30	.710"	3/4"	BT-20	.014	1
701-NB-30	\$.35	.725"	3/4"	BT-30	.014	1
701-NB-50	\$.40	.950"	1"	BT-50	.040	4
671-NB-55	\$.45	1.283"	1 1/4"	BT-55	.115	4
651-NB-60	\$.50	1.595"	1 1/2"	BT-60	.190	4
701-NB-1MT	\$.40	.937"	1"	Mailing Tube	.040	4

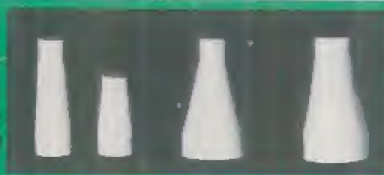
### STAGE COUPLERS

Little tubes with many uses, stage couplers exactly fit the inside of the tube designated. Great for multi-staging, joining body tubes, positioning adapter rings, etc. More perfect guides for cutting body tubes and smoothing cut edges of body tubes, too. Extra durable, lightweight. Shipping weight for all stage couplers is 3 oz. each.



Catalog No.	Price Each	Outside Diameter	Inside Diameter	Length	Fits	Average Weight
651-JT-5C	\$.10	.513"	.455"	3/4"	BT-5	.020 oz.
651-JT-20C	\$.10	.708"	.650"	3/4"	BT-20	.027 oz.
651-JT-30C	\$.10	.724"	.650"	3/4"	BT-30	.030 oz.
651-JT-50C	\$.15	.949"	.920"	1"	BT-50	.051 oz.
651-JT-55C	\$.15	1.28"	1.25"	1.3"	BT-55	.088 oz.
651-JT-60C	\$.15	1.59"	1.55"	1 1/2"	BT-60	.124 oz.
671-JT-70A	\$.20	2.175"	2.115"	1 1/4"	BT-70	.140 oz.

### BALSA ADAPTERS

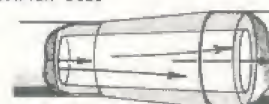


Super light, precision made balsa adapters give unlimited flexibility for model rocket design. Switch from one size body tube to another for payload capsules, parachute compartments, propulsion sections, etc. Adapters fitting BT-20 can be built up with masking tape to fit BT-30. Any adapter can be hollowed with a knife or drill to make a passage for ejection gases. All adapters have at least 1/2" mating surface on each end.

BALSA TUBE ADAPTER USES



Adapt large payload tube to small booster



Pass ejection gases into larger tube

Catalog No.	Price Each	Mates	Length	Tube Length	Weight oz. Net	Ship.
651-TA-520	\$.30	BT-5 to BT-20	1.75"	0.75"	0.04	1
651-TA-550	\$.35	BT-5 to BT-50	2.2"	1.0"	0.06	4
701-TA-2050	\$.45	BT-20 to BT-50	3.0"	2.0"	0.15	4
651-TA-2050A	\$.35	BT-20 to BT-50	2.0"	1.0"	0.11	4
681-TA-2055	\$.45	BT-20 to BT-55	2.5"	1.5"	0.22	4
651-TA-2060	\$.60	BT-20 to BT-60	3.0"	2.0"	0.20	4
701-TA-5055	\$.55	BT-50 to BT-55	2.0"	1.0"	0.60	4
651-TA-5060	\$.60	BT-50 to BT-60	3.0"	2.0"	0.23	4
701-TA-5065	\$.65	BT-50 to PST-65	3.0"	2.0"	0.26	4
701-TA-5560	\$.60	BT-55 to BT-60	2.7"	1.0"	0.25	4
701-TA-5565	\$.65	BT-55 to PST-65	2.7"	1.5"	0.38	4
701-TA-6065	\$.60	BT-60 to PST-65	2.0"	0.5"	0.23	4
701-TA-6070	\$1.00	BT-60 to BT-70	2.7"	1.5"	0.65	4

### ENGINE BLOCKS

The lightweight precision fitting engine blocks for the best internal construction on your models. Used for positioning the engine in your rocket for thrust, engine blocks provide a hollow butt-head against which the engine pushes as it develops its thrust, as well as an opening through which gases pass forward unobstructed for normal ejection.

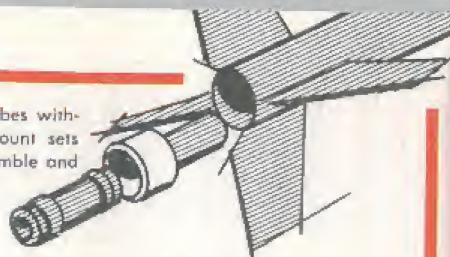


Catalog No.	Price 3 for	Outside Diameter	Inside Diameter	Length	Fits	Weight oz. Net	Ship.
651-EB-20A	\$.20	.708"	.65"	1 1/4"	BT-20	.009	1
651-EB-20B	\$.20	.708"	.65"	1 1/8"	BT-20	.005	1
651-EB-30A	\$.20	.724"	.65"	1 1/4"	BT-30	.010	1



## ENGINE MOUNTS

Get a precision engine fit in large body tubes without adding unnecessary weight. Engine mount sets come complete with instructions — just assemble and glue in place in your model.



**EH-2050** Fits BT-50, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-50C for positioning rings. Net weight 0.1 oz. Shipping weight 5 oz. Cat. No. 651-EH-2050 ..... \$ .35 each

**EH-2055** Fits BT-55, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-55C for positioning rings. Net weight 0.14 oz. Shipping weight 5 oz. Cat. No. 651-EH-2055 ..... \$ .35 each

**EH-2060** Fits BT-60, includes BT-20J, EB-20A, 2 rings for centering holder tube, and JT-60C for positioning rings. Net weight 0.17 oz. Shipping weight 5 oz. Cat. No. 651-EH-2060 ..... \$ .35 each

Mounts for D engines are on page 97

## PAPER ADAPTERS

Add still another dimension to rocket design. Easy to use paper adapters are perfect for making transitions between tube sizes for countless designs.

**MULTI-PURPOSE SET** — Includes a total of 20 rings for positioning BT-5 in BT-20; BT-5, BT-20, BT-30 in BT-50; and BT-5, BT-20, BT-30, and BT-50 in BT-60. Also three universal tapered shrouds and instructions. Shipping wt. 2 oz.

Cat. No. 701-TA-1 ..... \$ .40

**20-50 RINGS** — 20 rings for centering and mounting BT-20 in BT-50. Shipping weight 2 oz.

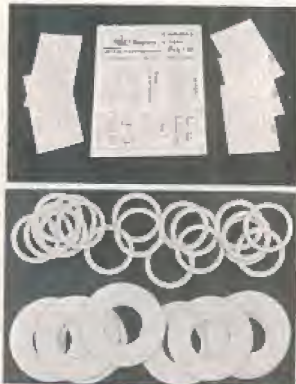
Cat. No. 651-RA-2050 ..... \$ .30 per set

**20-55 RINGS** — 10 rings for centering and mounting BT-20 in BT-55. Shipping wt. 2 oz.

Cat. No. 671-RA-2055 ..... \$ .30 per set

**20-60 RINGS** — 10 rings for centering and mounting BT-20 in BT-60. Shipping weight 2 oz.

Cat. No. 651-RA-2060 ..... \$ .30 per set



## CENTERING RINGS



Easy to use for centering a BT-20 body tube with a BT-50. Offering good alignment and fit, the AR-2050 adapter rings' greater strength makes them a good choice for use in model rockets that are to be flown with high thrust engines. Weight per pair .285 oz. Shipping wt. 3 oz.

Cat. No. 681-AR-2050 ..... 10 for \$ .40

Use these rings to center a BT-50 tube in a BT-55 body tube. Extra strong for "D" engine mounts. Weight 0.062 oz. each. Shipping weight 2 oz. Cat. No. 694-AR-5055 ..... 4 for \$ .25

## FIN STOCK

Top quality balsa sheeting for making fins for model rockets. For maximum strength, grain of wood should follow the leading edge of fin. Read **FINS** in Vol. 3, No. 3 of the **MODEL ROCKET NEWS** for more information.



Catalog No.	Price	Dimensions (In inches)	Weight oz.		Major Use
			Net	Ship.	
701-BFS-10	3 for \$ .50	1/32 x 3 x 9	.065	4	High Performance
651-BFS-20	3 for \$ .40	1/16 x 3 x 9	.130	4	High Performance
651-BFS-20L	3 for \$ .55	1/16 x 3 x 12	.173	6	High Performance
651-BFS-20B	2 for \$ .10	1/16 x 1/2 x 6	.015	2	Glider Elevon
651-BFS-30	3 for \$ .45	3/32 x 3 x 9	.150	4	Sport Models
651-BFS-30L	3 for \$ .60	3/32 x 3 x 12	.200	6	Sport Models
701-BFS-40	3 for \$ .55	1/8 x 3 x 9	.200	4	Cluster Rockets
701-BFS-40L	3 for \$ .70	1/8 x 3 x 12	.265	6	Glider Wings
701-BFS-60S	3 for \$ .20	3/16 x 1/2 x 3.7	.020	2	Scout Fin Replacement
701-BFS-80	\$ .40 each	1/4 x 2 x 17	1.00	12	Sky Slash Body
711-BFS-30W	\$ .75 each	4 x 18	.50	16	Boost Glider

**CLEAR PLASTIC FIN STOCK:** Build flyable models of finless space boosters and retain scale appearance. Clear plastic fins can be practically invisible, yet can also be as large as needed for proper stability. Recommended practice is to form a tube of 0.020" thick plastic to slide onto the outside of your model and glue fins made from 0.040" thick plastic to this tube. Use clear butyrate dope for gluing and filletting. In 3" x 9" sheets, shipping weight 4 oz.

Cat. No. 701-CFS-20 ..... \$ .25 each

Cat. No. 701-CFS-40 ..... \$ .50 each



**FIN PATTERN SHEET NO. 2:** Fourteen different popular fin designs, all tried and proven, printed full size on heavy index stock. Simply cut out and trace around pattern to transfer design to balsa. A must for the model rocket designer. Shipping weight 1 oz.

Cat. No. 651-PP-2 ..... \$ .25

**FIN PATTERN SHEET NO. 3:** Fifteen different fin designs. Same stock as sheet No. 2. A great help in developing new rockets. Shipping weight 1 oz.

Cat. No. 681-PP-3 ..... \$ .25





Give  
your  
rockets  
the  
professional  
look

## DECALS



**STARS AND BARS:** Sheet of 12 red, white and blue Air Force emblems, each 1 1/4" wide. Fit on fins and body tubes, look great on gliders. Shipping weight 1 oz.  
**Cat. No. 651-D-1** . . . . . \$ .15 each

**LARGE STARS AND BARS:** Add a special touch to your large models. Sheet contains two large 2" insignia, two medium 1 3/4" insignia and appropriate designations. Shipping weight 1 oz. **Cat. No. 651-D-2** . . . \$ .15 each

**1/4" LETTERS AND NUMBERS:** Ideal for code markings and identification on smaller rockets. Sheet contains 65 characters 1/4" high. Available in black or white. **Specify color when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-4** . . . . . \$ .15 each

**3/8" LETTERS AND NUMBERS:** Identify and decorate models the easy way with these 3/8" high letter and number decals. Sheet contains 62 characters. Available in black or white. **Specify color when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-3** . . . . . \$ .15 each

**LAUNCH PANEL DECAL:** Identify controls and circuits on your launch panel with this easy-to-apply, pressure sensitive decal sheet. Aluminum letters on black background are easy to read, add extra eye appeal. Self-adhesive, just cut out and press in place. Extra-strong mylar sheet measures 3 1/2" x 4 3/4". Shipping weight 1 oz. **Cat. No. 651-D-10** . . . . . \$ .50 each

**DECORATING TAPE, black:** Thin, tough pressure sensitive tape is perfect for stripes, bars and other decoration. Easy to apply and only .0015" thick, decorating tape comes in rolls 1/2 inch wide and 144 inches long. Can be cut with knife and straightedge for special sizes.  
**Cat. No. 701-DT-1, shipping wt. 5 oz.** . . . . . \$ .30 each



**1/5" CHECKERBOARDS:** Glossy, colorful 1/5" square checks on clear background. Add color contrast to model for easy tracking and eye appeal. Extra-large sheets, 9 1/2" x 4", available in red, black, gold or white. **Specify color and check size when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-7** . . . . . \$ .25 each

**3/8" CHECKERBOARDS:** Big 3/8" square checks for your large models. Cut out special patterns for even more striking effects. Large 9 1/2" x 4" sheets, available in red, black, white, gold or silver. **Specify color and check size when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-8** . . . . . \$ .25 each

**"20" DECAL:** 3" x 4 1/2" decal just right for BT-20 size models. Printed black on clear backing. Shipping wt. 1 oz. **Cat. No. 693-KD-45** . . . . . \$ .15 each

**"50" DECAL:** 4-color, 4" x 9" decal for BT-50 size models. Shipping wt. 1 oz. **Cat. No. 693-D-13** . . . . . \$ .50 each

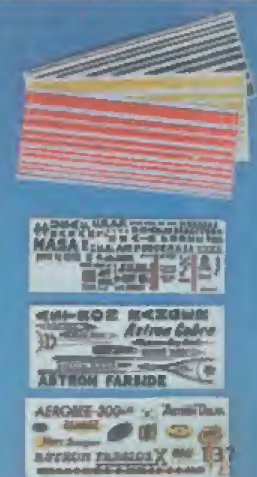
**MODEL MARKINGS:** Collection of black markings, numbers, patterns, etc., on 4" x 9" clear backing. Shipping weight 1 oz. **Cat. No. 692-D-12** . \$ .25 each

**COLOR STRIPES:** Put vertical stripes and horizontal rings on models the easy way. Each sheet has ten stripes, 1/32" through 1/2" wide and 9 1/2" long. Available in red, black or yellow. **Specify color when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-9** . . . . . \$ .25 each

**GOLD MINE SPECIAL:** A real gold mine of decorative decals for your models. Lettering, vents, hatches, rivets and more, all on one big 3 1/2" x 8 1/2" sheet. Printed in brilliant red, white and black to add extra color. Shipping weight 1 oz. **Cat. No. 651-D-5** . . . . . \$ .25 each

**#1 KIT NAMES DECAL:** Dress up models with these special kit names decals. Identify and decorate — easy to apply. Comes in black or white. **Specify color when ordering.** Shipping weight 1 oz. **Cat. No. 651-D-6** . . . . . \$ .25 each

**#2 KIT NAMES DECAL:** Extra colorful, this decal includes names for kit numbers K-7, 9, 12, 14, 15, 16, 17, 18 and 20 on a big 3 1/2" x 8 1/2" sheet. Printed in stand-out colors of red, yellow, white and black, this sheet provides the extra touch for good looking models. Shipping weight 1 oz. **Cat. No. 651-D-11** . \$ .25 each





## LITTLE ITEMS THAT GIVE BIG RESULTS IN ROCKETRY



**PHANTOM ENGINE:** For display and demonstrations, here's  $\frac{1}{2}$  an engine, cut the long way to show placement of nozzle, propellant, etc. Helps explain model rocket operation. Safe, uses only non-combustible materials. Shipping weight 1 oz.

Cat. No. 651-CE-1 ..... \$ .50



**ENGINE HOLDER:** Flat spring steel design gives easy installation and low drag. Recommended for sport and demonstration models built from BT-20 and BT-30, the engine holder is 2.8" long, 0.1" wide and only 0.025" thick. Mount it on the model with gauze and glue as shown on page 60. Net weight 0.032 oz. Shipping weight 1 oz.

Cat. No. 701-EH-2 ..... \$ .20



**SHORT ENGINE HOLDER:** Specially designed for use with Series III engines and BT-20 and BT-30 body tubes, this holder is 1.8" long and 0.1" wide for the same easy installation and low drag as the standard model. Net weight 0.022 oz. Shipping weight 1 oz.

Cat. No. 701-EH-3 ..... \$ .20



**FOAM PADDING:** Protect payload specimens, pad payload capsules with plastic foam. Pieces are 6" x 6" x  $\frac{1}{4}$ ". Can be cut and secured in place with white glue. Net weight 0.08 oz. Shipping weight 1 oz.

Cat. No. 651-PSP-1 ..... \$ .20



**PAYLOAD:** How high can your rocket lift an ounce of lead? This 1 oz. payload weight,  $\frac{3}{4}$ " in diameter, is used in some altitude competition events. Shipping weight 2 oz.

Cat. No. 651-PL-1 ..... \$ .50



**NOSE CONE WEIGHT:** Balance rockets for perfect stability with these  $\frac{11}{16}$ " diameter lead weights. Center hole for easy attachment and alignment. Stack several for more weight, cut with scissors for less. Each weighs 0.12 oz. Shipping weight 1 oz.

Cat. No. 701-NCW-1 ..... 3 for \$ .30



**NOSE CONE WEIGHT:**  $\frac{7}{16}$ " diameter brass washers for delicate balancing.  $\frac{1}{8}$ " center hole, weighs 0.023 oz. Attach up to four weights to nose cone by threading them on the screw eye. Shipping wt. 1 oz.

Cat. No. 701-NCW-2 ..... 10 for \$ .20



**BALANCING WEIGHT:** Flexible lead strip makes glider trimming a snap. Great for other balancing purposes too. Comes in 3" x  $\frac{1}{4}$ " x 0.02" strips, net weight 0.085 oz. Shipping weight 1 oz.

Cat. No. 701-NCW-3 ..... 5 for \$ .15

**LAUNCH LUGS:** Super strength laminated launch lugs feature mylar plastic core for durability, paper outer layer for easy gluing. Inside diameter  $\frac{5}{32}$ ", fit  $\frac{1}{8}$ " rad. Shipping weight 1 oz.

$1\frac{1}{4}$ " long, Cat. No. 691-LL-2A .6/\$ .15    5" long, Cat. No. 701-LL-2C .3/\$ .20  
 $2\frac{1}{4}$ " long, Cat. No. 651-LL-2B .5/\$ .15    8" long, Cat. No. 701-LL-2D .2/\$ .20



**GAUZE REINFORCING:** Attach shock cords, reinforce fin joints with unmarked gauze. Comes in 3" x 12" sheets. Apply by spreading a thin layer of glue over the area to be reinforced, smooth gauze down over the glue and spread one or more layers of glue over the gauze. Shipping weight 1 oz.

Cat. No. 651-GR-2 ..... 3 for \$ .30



**PAPER REINFORCING:** Double fin strength with this easy to use, self-adhesive treated paper. Cut to shape, strip off protective backing and press on the balsa. Apply to both sides of the balsa for best results. Provides smooth white surface for painting. In 3" x 9" sheets. Shipping weight 1 oz.

Cat. No. 651-PRM-1 ..... 3 for \$ .20



**TAPE HINGES:** Easy to use elevon hinges for boost-gliders. Treated paper,  $4\frac{1}{2}$ " x  $\frac{3}{4}$ ", adhesive coated on one side. Strip off protective backing, apply to joint. Shipping weight 1 oz.

Cat. No. 651-TH-1 ..... 2 for \$ .10



**ELASTIC THREAD:** Strong elastic thread, use as a spring to actuate elevons on boost-gliders. Each thread is 8" long,  $\frac{1}{32}$ " diameter. Shipping weight 1 oz.

Cat. No. 651-ET-1 ..... 3 for \$ .10



**NYLON SCREWS:** Extra light, high strength screws for elevon adjustment on boost-gliders.  $\frac{1}{2}$ " long,  $\frac{1}{16}$ " thread diameter. Read TR-4 for information on gliders and their design. Shipping weight 1 oz.

Cat. No. 651-AS-1 ..... \$ .10 each



**STYROFOAM BALLS:** Featherweight 3" diameter styrofoam balls for "odd ball" designs. Use white glue for best results in attaching legs, antennas, stabilizers, etc. Net weight 0.2 oz., shipping weight 5 oz.

Cat. No. 701-SB-3 ..... \$ .30



**DOWELS:** Extra strong, light weight, seasoned maple dowels. Shipping weight 5 oz.

$\frac{1}{8}$ " x 18" — Cat. No. 651-WD-1 ..... 4 for \$ .20

$\frac{1}{12}$ " x 12" — Cat. No. 671-WD-2 ..... 4 for \$ .20



**GLUE GUN:** Handles all makes of glue and cement. Conserves glue, speeds assembly. Shipping weight  $1\frac{3}{4}$  oz.

Cat. No. 711-66-1 ..... \$1.50





### Catalog Number Cross Reference Index

Catalog Number Cross Reference Index

No.	Price	Page	No.	Price	Page	No.	Price	Page	No.	Price	Page	No.	Price	Page	No.	Price	Page
A			BT-10H	.15	126	EM-2050	.35	97	K-26	2.25	39	MRN-V10-1	.25	113	RC-1	6.50	54
A-1	3.00	106	BT-20	.30	126	EM-5063	.50	97	K-27	2.00	39	MRN-V10-2	.25	113	RC-8	22.95	53
AC-1	.30	107	BT-20B	.15	126	EP-1	1.20	120	K-28	3.25	39	MT-1	.40	103	RL-18A	.30	104
AL-6	.20	105	BT-20D	.15	126	EP-2	1.20	120	K-29	10.95	43	MY-8	4.95	53	RL-3	3.00	101
AL-12	.20	105	BT-20G	.10	126	ES-55	5.50	122	K-30	3.25	45				RL-4	2.50	99
AP-1	.35	120	BT-20J	.10	126	ES-110	11.00	123	K-31	1.25	29				RRL-1	.35	102
AR-2050	10/40	134	BT-20M	.10	126	ES-165	16.50	124	K-32	2.35	27				RRL-3	.25	102
AR-5055	4/25	134	BT-30	.30	126	ET-1	3/10	139	K-33	4.00	49	N			RP-1A	.40	131
AS-1	.10	139	BT-30A	.30	126	ENGINES		92-95	K-34	2.00	31						
			BT-30B	.20	126	1/4A	all types 35¢	3/70	K-35	2.00	41	NB-20	.30	132	S		
			BT-30C	.20	126	1/2A	all types 40¢	3/80	K-36	13.50	23	NB-30	.35	132	SB-3	.30	139
			BT-30F	.25	126	3/4A	all types 45¢	3/90	K-37	4.25	27	NB-50	.40	132	SC-1	.10	131
			BT-30J	.15	126	B4 O(P)	.50¢	3/1.00	K-38	3.25	23	NB-55	.45	132	SC-2	.15	131
			BT-50	.40	126	B4 & B6	all types 50¢	3/1.10	K-39	3.50	41	NB-60	.50	132	SC-3	.20	131
			BT-50H	.25	126	B14	all types 55¢	3/1.10	K-40	1.25	23	NB-1MT	.40	132	SE-1	3/10	131
			BT-50J	.15	126	C	all types 60¢	3/1.20	K-41	3.50	45	NCD-2	3/10	128	SE-2	3/10	131
			BT-50L	.35	126	D	all types 75¢	3/2.00	K-42	3.25	49	NCK-29	1.75	117	SE-3	3/10	131
			BT-50S	.20	126				K-43	6.00	49	NCS-10	1.00	117	SP-2	6/10	121
			BT-50W	.30	126	F			K-44	1.60	51	NCS-1A	.20	128	SPL-2	6/10	121
			BT-55	.60	126	FCB-71	1.75	56	K-45	1.50	23	NCS-2A	1.20	128	SR-3	1.40	107
			BT-55S	.20	126	FDP-1	.50	56	K-46	4.75	23	NCW-1	3/30	138	SR-4	4.00	107
			BT-55V	.55	126	FDP-2	2.00	56	K-47	2.75	25	NCW-2	10/20	138	SS-1	.25	121
			BT-60	.65	126	FFH-4	4/2.00	56	K-49	1.75	29	NCW-3	5/15	138	SS-2	.80	120
			BT-60D	.50	126	FM-1	.30	121	K-50	4.95	47	NF-6	6/75	56	SV-12	6/25	131
			BT-60J	.15	126	FP-1	1.40	120	K-51	3.25	37	NP-1	.50	56	SWM-1	.90	105
			BT-60K	.35	126	FS-4	4.50	100	K-52	3.50	35	NW-30A	.50	103	SWR-1	1.45	105
			BT-60R	.25	126	FS-4B	5.50	100	K-52P	5.00	35	NW-32A	.50	103			
			BT-70	.85	126	FS-5	3.50	98	K-54	2.95	47	NWI-1	6/20	102			
			BT-101	1.75	126	FS-8	5.00	101	K-56	1.50	17						
			BTC-55Z	1.00	129	FS-8B	7.50	101	KD-45	.15	137	P					
						FSK-4	.10	101	KNB-1A	.10	119	P-1	.50	114			
						FSS-4	1.60	101	KNB-1B	.25	119	PB-3	.35 set.	121			
						FW-2	.85	121	KNB-1C	.25	119	PC-1	.29	121			
									KNB-2D	.35	119	PC-2	.15	121			
									KNB-3E	.15	119	PFB-1	.30	103			
									KNB-4F	.50	119	PFS-50A	.50	17			
									KNB-4G	.15	119	PK-8	.25	130			
									KNB-4H	.15	119	PK-12	.25	130			
									KNB-5J	.30	119	PK-18	.35	130			
									KNS-1	.75	119	PK-24	.50	130			
									KNS-2	1.25	119	PL-1	.50	130			
									KNS-3	.30	119	PM-2	.50	130			
									KNS-4	1.20	119	PM-3	.75	130			
									KNS-24	3.00	118	PNC-50K	.50	17			
									KNS-82	4.95	118	PF-2	.25	135			
									KNS-84	13.50	118	PP-3	.25	135			
									KNS-88N	32.50	118	PRM-1	3/20	139			
									KS-2	2.25	11	PRP-50	1.35 set.	47			
									KS-7	7.00	11	PRP-51	1.35 set.	37			
									KS-8	8.50	13	PRP-54	1.50 set.	47			
									KS-1A	2.75	105	PS-20A	.80	127			
									KS-1K	.25	105	PS-20C	.85	127			
												PS-30B	.65	127			
												PS-50A	.90	127			
												PS-50B	.85	127			
												PS-50C	1.60	127			
												PS-50D	1.50	127			
												PS-50E	1.75	127			
												PS-55B	1.25	127			
												PS-60A	1.60	127			
												PS-60B	1.50	127			
												PS-60C	1.75	127			
												PSM-1	1.00	127			
												PSP-1	.20	138			
												PST-20	.30	126			
												PST-20J	.15	126			
												PST-50S	.25	126			
												PST-60R	.50	126			
												PST-65R	.55	126			



# INDEX

## A

ADAPTERS	97, 134
Add-On-Rod	102
Adjustable Launcher	101
Aerobee 300 Kit	37
Aerodynamic Drag	
of Model Rockets	112
Alpha Kit	17
Alpha III Kit	17
Altiscope	106
Altitude Computer	107
Altitude Tracking Report	112
Aluminum Paint	120
Apogee II Kit	32
Apollo Capsule Kit	39
Aras Kit	39
Assembly Special	117
ASSORTMENTS	
(Supplies)	122-125
Astroreal	120
Avenger Kit	23

## B

Balancing Weights	138
Balls, Styrofoam	139
Balsa Adapters	133
Balsa Blocks	117
Balsa Fin Stock	135
Balsa Nose Cones	128, 129
Batteries	103
Battery Clips	103
Battery Contacts	103
Battery Pack	102
BEGINNER'S SPECIAL	13
Beta Kit	23
Big Bertha Kit	19
Birdie Kit	51
Blades, Knife	119
Blast Deflector, Deluxe	102
Blast Deflector Plate	102
Blocks, Engine	133
Blocks, Nose	132
Body Putty	121
BODY TUBES	126
BOOKS	113, 114
Boost-Glider Kits	31
Boost-Glider Report	112
Boost-Glider Information	80, 81
Bow Compass	110
Brush Cleaner, Thinner	121
Brushes, Paint	121
Building and Finishing	
Information	57-64
Bulbs, Light	105
Bulkheads, Engine	132
Butyrate Dope	120

## C

"C" Rail	104
Camroc Film	56
Camroc Kit	54, 55
Capsule, Payload	127
Centering Rings	134
Changing Bag, Camera	56
Cherokee-D Kit	25
Chutes	130
Cineroc Film	56

Cineroc Kit	52, 53
Clear Spray	120
Clear Plastic Sheet	135
Clips, Electrical	103
Cluster Report	112
Cluster Rocket	
Kits	25, 27, 41, 43
Clustering Information	74, 75
Cobra Kit	25
Compass	110
Computer, Altitude	107
COMPUTING EQUIPMENT	107
Cones, Nose	128, 129
Constellation Kit	21
Continuity Check Bulbs	105
Cord, Shroud Line	131
Corporal Kit	37
Couplers	132
Custom Assortments	122-125
Cut-Away Engine	138

## D

Data Sheet	107
DECALS	136, 137
Decorating Tape	136
Deflectors	102
'D' Engine Adapters	97
'D' Engines	9, 95
'D' Rocket Kits	25, 35, 37, 43
Design Notes, D-Rockets	96
Design of the Month	111
Delta Kit	35
Deluxe Starter Kit	13
Demonstration Engine	138
Design Manual	114
Dial Plate	105
Dope, Butyrate	120
Dowels, Maple	139
Dowels, Nose Cone	128
DRAWING EQUIPMENT	110
Drifter Kit	21

## E

Elastic Thread	139
Electrical	
Supplies	102, 103, 105
Electro-Launch	100
Electro-Launch, Phantom	101
Emery Boards	119
Enamel Paint	120
Engine Adapters, 'D'	97
Engine Blocks	133
Engine, Cut-Away	138
Engine Holders	138
Engine	
Information	84-86, 90, 91
Engine Mounts	134
Engines, Prices	92, 94
Engines, Rocket	90-95
ENGINES, Selection	
Chart	92-95

## F

Falcon Kit	31
Farside Kits	32
Film	56
Film Processing	35
Fin Pattern Sheets	135
Fin Reinforcing	139
FIN STOCK	135

FINISHING	
MATERIALS	120, 121
Finishing and Painting	
Information	76, 77
Firing Switch	101, 105
FIRING SYSTEMS	98-101
Flight Data Sheets	107
Flight Pack	56
Flameproof Wadding	131
Flight Information	65
Fluorescent Paint	120
Foam Padding	138
French Curve	110

## G

Gauze Reinforcing	139
Gemini-Titan Kit	41
Gliders	31
Glue	121
Glue Gun	139
Gauge, Blade	119
Graph Paper	107
Gyroscop	29

## H

Handviewer, Cineroc	53
Hinge, Elevon	139
Holders, Engine	138
Holder, Pilot Light	105
Honest John Kit	39

## I

Ignition Material	102, 103
IGNITION SYSTEMS	98-103
Igniters	102
Interceptor Kit	47
Interlock Key	101

## K

Key Switch	105
Kit Names, Decal	136, 137
Kits, Launcher	98-101, 104
Knives and Blades	118, 119

## L

Launch Controller	101
Launch Controller Switch	101
Launch Control System	98
Launch Pad Special	122
LAUNCHERS	98-101, 104
Launching Information	72, 73
Launching Lugs	139
Launching Rail	104
Launching Rods	102
Launching Supplies	98-105
Lead Wire	103
Lift-Off Special	123
Light, Pilot	105
Little Joe II Kit	45
Lugs, Launching	139

## M

Mark Kit	17
Mars Lander Kit	49
Mars Snooper Kit	49
Masking Tape	103
MATH SUPPLIES	106, 107

Measurements and Con-	
version Information	88
Mercury Capsule Kit	127
Mercury Redstone Kit	45
Micro-Clips	103
Midget Kit	23
MISCELLANEOUS	
SUPPLIES	138, 139
Model Rocket Design	108
Model Rocket Flight	8, 9
MODEL ROCKET NEWS	113
Model Rocket Performance	
Information	87
Modeling Tools, Kits	118, 119
Momentary Switch	105
Motors	90-95
Movie Camera, Cineroc	52, 53
Movie Film, Cineroc	53, 56
Mounts, Engine	134
Multi-Pad	99
Multi-Stage Kits	33, 35
Multi-Stage Report	112

## N

Nichrome Wire	103
Nighthawk Kit	31
NOSE BLOCKS	132
Nose Cone Dowels	128
Nose Cone Stock	128, 129
Nose Cone Weights	138
NOSE CONES	128, 129
Nylon Screw	139

## O

Omega Kit	35
Orbit Special	124
Orbital Transport Kit	49

## P

Padding, Foam	138
Paint	120
Paint Brushes	121
Painting and Finishing	
Information	76, 77
Paper Adapters	134
Paper Reinforcing Material	139
PARACHUTES	130
Patterns, Fin	135
Payload Padding	138
PAYLOAD SECTIONS	127
Payload Weight	138
Performance Information	87
Phantom Electro-Launch	101
Phantom Engine	138
Phantom Kit	51
Photographic Supplies	56
Photography, Rocket	52-56
Pilot Lights	105
Pivots, Launcher	102
Plan Booklet	114
Plastic Cement	121
Plastic Fin Stock	135
Porta-Pad Launcher	99
Posters	144
Power Supply	102
Protractor	110
Punch	119
Push Button Switch	105
Putty, Body	121

## R

Rail Joiner	104
Range Box	125
Range Kit Special	125
Ranger Kit	25
Razor Saw	119
RECOVERY	
EQUIPMENT	130, 131
Recovery Information	68, 69
Recovery Wadding	131
Reinforcing, Gauze	139
Reinforcing, Paper	139
Rings, Centering	134
Rocket Camera Kits	52-56
Rocket Engine Design	
Information	84, 85
ROD LAUNCHERS	99-101
Rod, Two Piece	102
Rotary Switch	105
Rubber Shock Cord	131
Rule	110

## S

Safety Code	145
Safety Information	82, 83
Safety Switch	105
Sandhawk Kit	37
Sanding Material	121
Sanding Sealer	121
Sandpaper	121
Saros Kit	47
Saturn V, Semi-scale Kit	41
Saturn V Kit	43
Saturn IB Kit	43
Saw	119
Scale Model	
Kits	37, 39, 41, 43, 45
Scale, Weighing	107
Scout Kit	19
Scrambler Kit	27
Screw Eyes	131
Screws, Nylon	139
Scriber	119
Selector Switch	105
Shock Cord	131
Shrike Kit	23
Shroud Lines	131
Sky Hook Kit	17
Slide Rules	107, 115
Snap Swivels	131
Soldering Iron	105
Spaceman Kit	51
Space Plane Kit	31
SPECIALS	
(Assortments)	122, 125
Special, Launch Pad	122
Special, Lift-Off	123
Special, Orbit	124
Special, Range Kit	125
Special Starter Outfit	15
Spray Paint	120
Spring Clips	103
Sprite Kit	21
Stability Information	66, 67
Stability Report	112
Stage Couplers	132
Staging Information	70, 71

## V

V-2 Kit	37
Viewer, Cineroc Movie	53

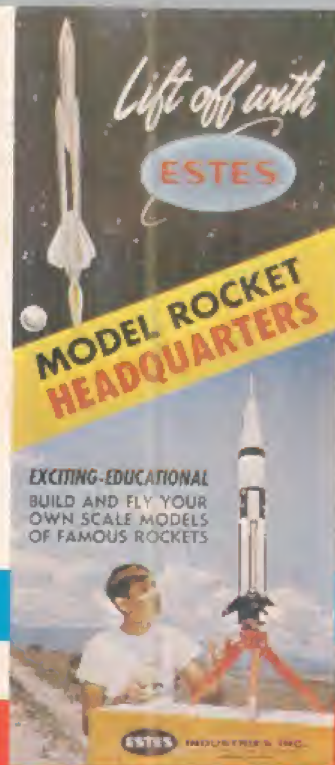
## W

WAC Corporal Kit	37
Wadding, Recovery	131
Wax	121
Weighing Scale	107
Weight, Nose Cone	138
Weight, Payload	138
Whetstone	119
White Glue	121
Wind Tunnel Plans	112
Wire, Lead	103
Wire, Nichrome	103

## X

X-Ray Kit	19
-----------	----





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## SAFETY

le — plus  
— equals  
launches



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any conditions which might be dan-  
gerous to people or property.

CH AREA — My model rockets will al-  
ways be launched from a cleared area, free  
of flammable materials, and I will only  
use non-flammable recovery wadding in  
rockets.

REFLECTOR — My launcher will have a  
reflector device to prevent the engine ex-  
haust from hitting the ground directly.

CH ROD — To prevent accidental eye  
injury I will always place the launcher so the  
rod is above eye level or cap the  
rod with my hand when approach.

I will never place my head or body  
in the launching rod. When my launcher  
is in use, I will always store it so that the  
rod is NOT in an upright position.

R LINES — I will never attempt to re-  
trieve my rocket from a power line or other  
hazardous places.

CH TARGETS & ANGLE — I will not  
launch rockets so their flight path will carry  
against targets on the ground and will  
not use an explosive warhead nor a pay-  
load intended to be flammable. My  
launching device will always be pointed within  
degrees of vertical.

LAUNCH TEST — When conducting re-  
covery activities with unproven designs or  
devices, I will, when possible, determine  
reliability through pre-launch tests. I  
will conduct launchings of unproven designs  
under complete isolation from persons not par-  
ticipating in the actual launching.

Revised 2/4/70

It is  
important to do my part in  
model rocketry has gained. In  
manner and will always be  
I pledge to follow the Rock-





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FRIEND'S NAME

ADDRESS

CITY

STATE

ZIP CODE

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### OLD ADDRESS

NAME

ADDRESS

CITY

STATE

ZIP CODE

### NEW ADDRESS

NAME

ADDRESS

CITY

STATE

ZIP CODE

ESTES

## MODEL ROCKET SAFETY

A recognized safety code — plus  
safe rocketry materials — equals  
24 million safe rocket launches

This Solid Propellant Model Rocketry Safety Code Is Approved by The National Association of Rocketry and the Hobby Industry Association of America

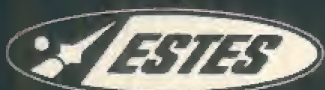
- CONSTRUCTION** — My model rockets will be made of lightweight materials such as paper, wood, plastic and rubber, without any metal as structural parts.
- ENGINES** — I will use only pre-loaded, factory-made model rocket engines in the manner recommended by the manufacturer. I will not change in any way nor attempt to reload these engines.
- RECOVERY** — I will always use a recovery system in my model rockets that will return them safely to the ground so that they may be flown again.
- WEIGHT LIMITS** — My model rocket will weigh no more than 453 grams (16 ozs.) at liftoff, and the engines will contain no more than 113 grams (4 ozs.) of propellant.
- STABILITY** — I will check the stability of my model rockets before their first flight, except when launching models of already proven stability.
- LAUNCHING SYSTEM** — The system I use to launch my model rockets must be remotely controlled and electrically operated and will contain a switch that will return to "off" when released. I will remain at least 10 feet away from any rocket that is being launched.
- LAUNCH SAFETY** — I will not let anyone approach a model rocket on a launcher until I have made sure that either the safety interlock key has been removed or the battery has been disconnected from my launcher.
- FLYING CONDITIONS** — I will not launch my model rocket in high winds, near buildings, power lines, tall trees, low-flying aircraft, or under any conditions which might be dangerous to people or property.
- LAUNCH AREA** — My model rockets will always be launched from a cleared area, free of any easy to burn materials, and I will only use non-flammable recovery wadding in my rockets.
- JET DEFLECTOR** — My launcher will have a jet deflector device to prevent the engine exhaust from hitting the ground directly.
- LAUNCH ROD** — To prevent accidental eye injury, I will always place the launcher so the end of the rod is above eye level or cap the end of the rod with my hand when approaching it. I will never place my head or body over the launching rod. When my launcher is not in use, I will always store it so that the launch rod is NOT in an upright position.
- POWER LINES** — I will never attempt to recover my rocket from a power line or other dangerous places.
- LAUNCH TARGETS & ANGLE** — I will not launch rockets so their flight path will carry them against targets on the ground and will never use an explosive warhead nor a payload that is intended to be flammable. My launching device will always be pointed within 30 degrees of vertical.
- PRE-LAUNCH TEST** — When conducting research activities with unproven designs or methods, I will, when possible, determine their reliability through pre-launch tests. I will conduct launchings of unproven designs in complete isolation from persons not participating in the actual launching.

Revised 2/4/70

### ROCKETEER'S PLEDGE

*I am proud to be a model rocketeer. I feel it is important to do my part in upholding the outstanding safety record that model rocketry has gained. In all my rocketry activities I will act in a mature manner and will always be considerate of other people and property rights. I pledge to follow the Rocketeer's Code of Safety.*





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